ANNUAL PROGRESS

REPORT 2017

SOUTHEAST SOUTH DAKOTA EXPERIMENT FARM

SOUTH DAKOTA AGRICULTURAL EXPERIMENT STATION

SOUTH DAKOTA STATE UNIVERSITY

This is an annual report of the research program at the Southeast South Dakota Research Farm in cooperation with South Dakota Agricultural Experiment Station, SDSU Plant Science, and SDSU Animal Science and has special significance for those engaged in agriculture and the agriculturally related businesses in the ten county area of Southeast South Dakota. The results shown are not necessarily complete or conclusive. Interpretations given are tentative because additional data resulting from continuation of these experiments may result in conclusions different from those based on any one year.

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The Southeast Farm is located at 29974 University Road, Beresford, SD 57004. Telephone 605-563-2989; Fax 605-563-2941; Farm Supervisor, Peter Sexton email (peter.sexton@sdstate.edu).

Internet web page: https://www.sdstate.edu/south-dakota-agricultural-experiment-station-sdsu/sdsu-southeast-research-station

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Peter Sexton, Farm Supervisor
Scott Bird, Research Assistant
Duane Auch, Research Assistant
Jared Thompson, Ag Technician (part-time)
Shane Snyders; Technician (part-time)
Brad Rops, Operations Manager
Ruth Stevens, Senior Secretary
Garold Williamson, Ag Foreman
Conner Thaler, Ag Technician (Summer)

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South Dakota State University, South Dakota Counties and U.S. Department of Agriculture Cooperating.

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The 2017 Southeast Research Farm Annual Progress Report is dedicated to Al Miron and Lon Hall, both of whom passed away in 2017. Al and Lon were huge contributors to the Southeast Research Farm and South Dakota agriculture.

Al Miron had been on the board of directors for the Southeast Research Farm since 2002 and was currently serving as vice president. He worked for CHS as an animal nutritionist and farmed near Crooks, SD, practicing no-till since 1988. Al was a founding board member for the South Dakota Soil Health Coalition and also served on the board for the South Dakota Corn Utilization Council. Al had a passion for soil conservation and shared his knowledge and experience across the state, nation, and internationally. In 2016 he was named the SDSU Eminent Farmer. “It’s important for all of us to make some contribution to society. Soil health is the area I feel I can work in and have some influence,” explained Al. “To see conservation practices adapted by more farmers gives me the satisfaction that we will have something to leave for future generations.”

Lon Hall started working under Dale Reeves as a research technician for the Oat Breeding Project at SDSU in 1975. During this time he went on to obtain his Master's Degree in Plant Science. In 2001, he became head of the Oat Breeding Program. Lon did oat breeding, variety testing, and foundation seed increases at the Southeast Research Farm. He worked very hard and took great pride in releasing several varieties of oats including Buff, Streaker, Colt, Stallion, Shelby427, Horsepower, Goliath, Hayden, and Natty. His lines are being raised over a large area, as far away as Michigan and Maine. He continued his research after his retirement in 2013, and started Halls Seed with his son, Jesse.

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ACKNOWLEDGEMENTS

First, I would like to recognize the passing of Al Miron, an active board member who was a good example both in his farming practices, and in his personal life and interest in community service. Al always had thoughtful insights to share at board meetings and had a very practical approach to problems. We will miss Al.

I would like to recognize all our collaborators at the SDSU Campus in Brookings and in SDSU Extension who conduct research at the farm, with livestock, soils, and crops. These researchers, many who have reports in this publication, contribute greatly toward the work done at the Southeast Farm and should be thanked for all the effort they put forth in promoting agricultural research in South Dakota. The Soybean Research and Promotion Council, and the SD Corn Utilization Council, support the farm through research grants and need to be acknowledged for their help. Our friends at the NRCS also support research at the farm and work with us on outreach activities – so we want to acknowledge them as well. Our board needs to be acknowledged for their critical contribution to the research farm and its continued success. Some of the work we do is basic research that is more academic in nature, and some is very applied – we are glad to work on both. Hopefully in the end it all bears good fruit.

The staff at the farm this past year - Garold Williamson, Ruth Stevens, Brad Rops, Scott Bird and Duane Auch – kept the farm going from day to day. The farm would not get very far in terms of research done without the good work of the staff. Connor Thaler, Jared Thompson, and Shane Snyders worked for the farm part-time and were an asset to the farm in mowing, collecting data, repairing equipment, and helping to keep weeds at bay.

The support of Dr. Bill Gibbons, Interim Director of Ag Experiment Station at SDSU; Dr. David Wright, Dept. Head, SDSU Agronomy, Horticulture & Plant Science; and Dr. Joe Cassidy, Dept. Head, SDSU Animal Science, has also been important for the farm's operation. We look forward to continuing and expanding our interaction with SDSU faculty and college administrators in the coming year.

As always, we are thankful to God for another year that we can move forward with work. We hope it will be a productive one. One day at a time.

This publication was edited and compiled by Ruth Stevens and Peter Sexton. The 2017 Annual Report, as well as Annual Reports from other years, is available on SDSU website:
https://www.sdstate.edu/south-dakota-agricultural-experiment-station-sdsu/sdsu-southeast-research-station

OUTREACH ACTIVITIES

Seminars at Dakota Farm Show; January

Livestock Handling Workshop; March

IPM Training School, July

Forage Fiesta; August

INTRODUCTION .... Pete Sexton
Farm Supervisor

This report provides summaries of most of the research trials done at the SDSU Southeast Research Farm in 2017. The farm's strategic goals as set by Southeast Farm Board continue to be:

1) *Improve the character of the soil (soil quality);*
2) *Achieve grain yield goals and optimize cost of production and profitability;*
3) *Optimize livestock production including use of novel approaches in integrating livestock and crop production;*
4) *Increase association membership and improve public relations and outreach;*
5) *Broaden scope of research to include small-scale and beginning farmers and horticulture work as opportunity permits.*

The overall objective here is to contribute to the public welfare for folks in southeast South Dakota by conducting unbiased agricultural research. Most of the land at the Southeast Farm is no-tilled, both as a matter of economy and also to conserve the soil. We have been working towards incorporating cover crops and grazing into the system over the past five years as circumstances allow – again partly as a way to add value to crops, and also as a step forward in promoting soil quality. When the price of corn is high this path doesn't seem to be economical, but when corn prices are low, incorporating annual forages and grazing into the cropping system looks like a good option to have on the table.

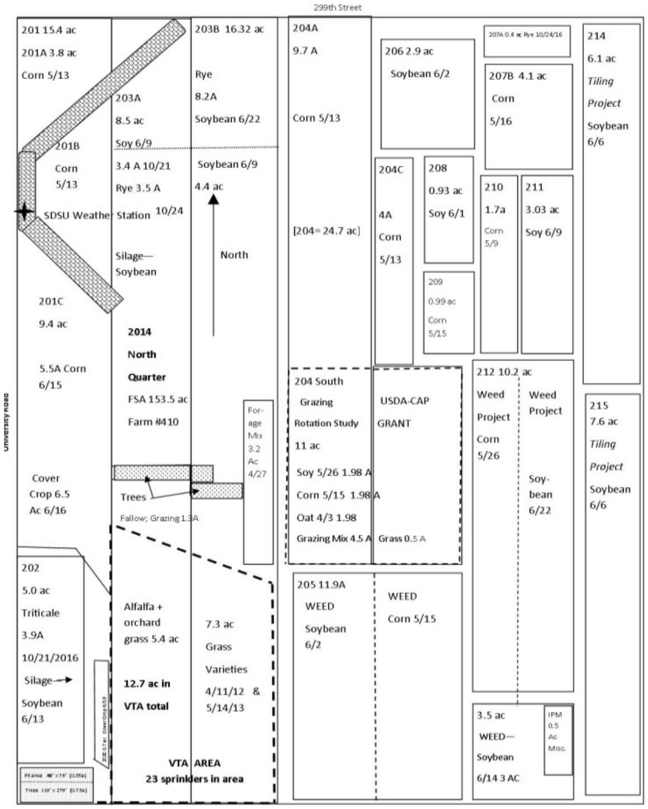
We are looking at a couple of new crops for the area – winter canola and soft white winter wheat – time will tell if they have a fit here. Winter canola did not overwinter well last year and stands were poor in the spring of 2017, but we aren't giving up on it yet. If these crops can find a productive place here, that may provide a way to profitably increase diversity in our rotation and thus benefit the system by disrupting weed, pest, and disease cycles. We did not do a lot with our high tunnel in 2017, we hope to do more with that in the in the coming season.

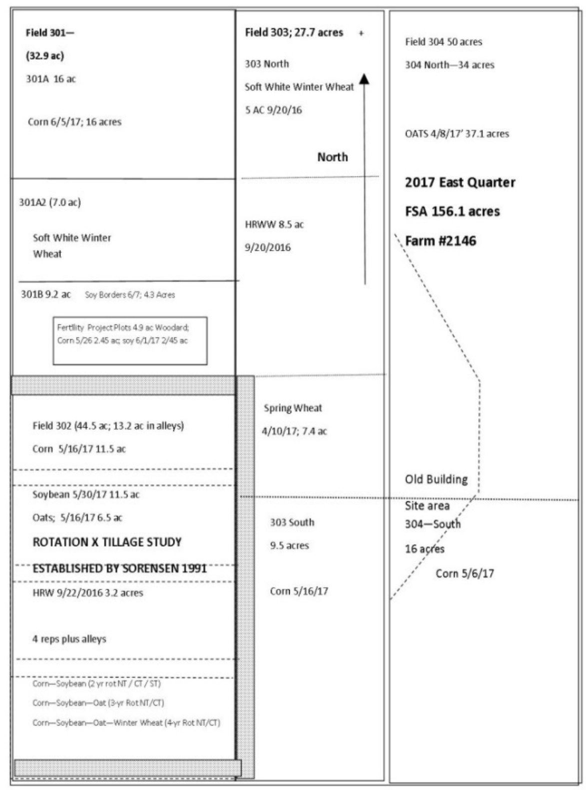
The farm completed some major improvements in infrastructure in 2017. About 90 acres were tiled. We hope to install some biofilters in the coming season, and perhaps put in a managed wetland to help look at ways of improving water quality from tile drainage systems. We are also embarking on a project to measure the impact of a winter rye cover crop on improving quality of tile drainage water and improving soil health. What strikes me as I reflect on all this is that some of the problems we face may run on a time cycle that is much longer than our own lives or economic time span, which makes it difficult for us to detect the problem as it develops – hence the need for reflection, prayer, and wisdom in identifying things to work on.

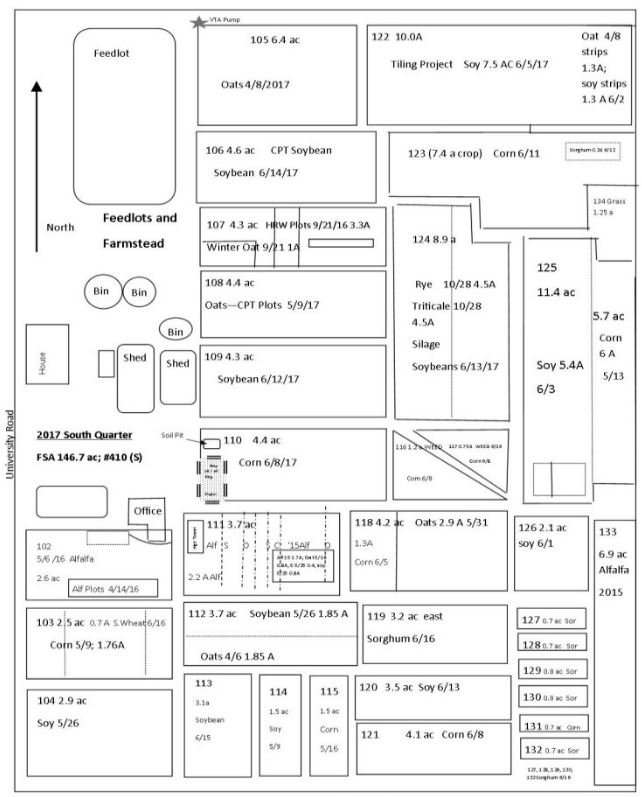
Improvements to the feedlot sorting pens were completed in 2017 and we are currently hosting a couple research projects with beef cattle and also the "calf value discovery" program in the farm's feedlot. The small hog barn here is also in use raising feeder pigs from the SDSU's new farrowing unit in Brookings and also conducting work on swine nutrition. We plan to carry on with our collaborators at SDSU to facilitate their work with livestock and crop research. We are always looking to improve on our efforts and like to listen to new ideas - please feel free to stop in and visit or call to share suggestions and comments about our research. We plan to have our Summer Field Day on July 10, and a fall one on September 6, God willing. We hope that you can make it to Beresford for these events and that you have a good year ahead.

2017 Land Use Map (maps not drawn to scale)

Southeast Research Farm, Beresford, SD







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Weather and Climate Summary; SDSU Southeast Research Farm, Beresford, SD 2017

Ruth Stevens*, Peter Sexton, Brad Rops, Scott Bird, and Garold Williamson

In 2017 the SDSU Southeast Research Farm received above average moisture in the spring and again in late summer. Spring moisture along with cool May temperatures caused planting delays and problems with emergence of some crops. A warm and dry period in June and July caused drought symptoms to develop in some fields. Moisture received in August allowed crops to recover from stress of dry weather and complete growth cycle without significant yield loss. Another dry period mid-October through December allowed harvest and any fall work to be completed in a timely manner.

The weather and climate information for the Southeast Farm in 2017 is summarized in tables and graphs found on pages 2-6.

In 2017 seven months had above average maximum temperatures and three months had below normal minimum temperatures (Table 1). During 2017 growing season April, May, and August had below average maximum temperatures; while May and August also had below normal minimum temperatures. Average temperatures compared to daily temperatures are highlighted in Figure 1.

Annual precipitation and growing season precipitation were 115% and 119% of normal, respectively. Southeast Farm received 29.5” of annual precipitation (Table 2 and 3). Growing season precipitation measured from April through September was 22.87”. Southeast Farm had five months in 2017 that received above average precipitation (+0.07” to +4.91”), and seven months with below normal precipitation (-0.36” to -2.03”). Southeast Farm received 29” of snow fall in 2017; 24” in first half of year and 5” in November and December.

The coldest and hottest temperatures of the year were recorded on December 31 (-18°F) and July 16 & 26 (96°F) respectively, a 114-degree temperature range (Table 3). Frost-free season at the Southeast Farm in 2017 was 161 days on a 32°F basis and 183 days on a 28°F-basis. The last spring frost was on May 2 (32°F) and last freeze was on April 11 (22˚ F). The first fall frost was on October 10 (29˚F) and a freeze occurred on October 11 (25˚F). The average annual high temperature was 59°F and average annual low temperature was 37°F; which were both above average (+0.4 and +1.6 degrees, respectively).

The 2017 growing season (April – October) accumulation of growing degree units (GDU’s) was 3043 units (103% of average). May and August had below normal GDU’s in 2017 (Fig. 3 & 4). Evaporation recorded at the Southeast Farm from May through September 2017 was 33.2” (Fig. 6 & 7). Southeast Farm received 19.5” of rainfall during the same period of time.

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Table 1. Temperatures[1] at the Southeast Research Farm - 2017

	2017 Average Air Temps. (°F)		65-year Average Air Temps. (˚F)		Departure from 65-year Average (˚F)	
	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum
January	28.3	13.5	26.6	5.8	+1.7	+8.0
February	40.5	20.7	32.3	11.3	+8.2	+9.4
March	44.0	25.5	44.2	23.0	-0.2	+2.5
April	59.7	37.4	60.2	35.2	-0.5	+2.2
May	68.2	45.5	71.9	47.3	-3.7	-1.8
June	84.1	58.0	81.5	57.7	+2.6	+0.3
July	87.5	63.4	86.0	62.1	+1.5	+1.3
August	77.7	56.1	83.9	59.4	-6.2	-3.3
September	76.7	52.0	75.6	49.2	+1.1	+2.8
October	62.5	36.6	64.5	38.2	-1.7	+1.3
November	46.8	22.1	45.4	23.8	+1.4	-1.7
December	32.9	12.4	30.7	11.5	+2.2	+0.9

[1] Computed from daily observations

Table 2. Precipitation at the Southeast Research Farm – 2017

Month	Precipitation 2017 (inches)	65-year Average (inches)	Departure from Avg. (inches)
January	0.53	0.46	+0.07
February	0.33	0.80	-0.47
March	1.06	1.42	-0.36
April	3.38	2.57	+0.81
May	5.57	3.52	+2.05
June	2.12	4.15	-2.03
July	1.35	3.08	-1.73
August	7.97	3.06	+4.91
September	2.48	2.76	-0.28
October	4.49	1.90	+2.59
November	0.10	1.15	-1.05
December	0.08	0.65	-0.57
Totals	29.46	25.51	+3.95

ACKNOWLEDGEMENT:

Weather data is compiled from daily observations collected by Southeast Farm Personnel in cooperation with South Dakota State Climatologist, South Dakota Office of Climatology and SDSU Extension, and the National Weather Service, Sioux Falls, SD. More climate information available at South Dakota State University – South Dakota Climate and Weather site: https://climate.sdstate.edu/mobile/sdmesonet/county_weather.asp?num=174

Table 3. 2017 Climate Summary Southeast Research Farm, Beresford, SD

Annual Precipitation (inch)	29.5	115%*
Growing Season Precip (Apr-Sep, inch)	22.87	120%
Jan-Mar	1.92	72%
Apr-Jun	11.07	108%
Jul-Sep	11.80	133%
Oct-Dec	4.59	124%
Annual Snow (inch); (Jan-Jun/Jul-Dec)	23.5/5.6	29.1 total
Growing Degree Units (GDU); Apr – Oct	3043	103%
Minimum / Maximum Air Temp, ºF	-18° F Dec 31	96° F July 16 & 26
Last Spring Frost; 32º / 28º basis	May 2 - 32° F	Apr 11 - 22°F
First Fall Frost; 32º / 28º basis	Oct 10 - 29°F	Oct 11 - 25°F
Frost Free Period (days); 32º / 28º basis	161	183
Average Annual High / Low	59 / 37	+0.4 / +1.6

* % of Normal

Figure 1. 2017 Average Temperatures

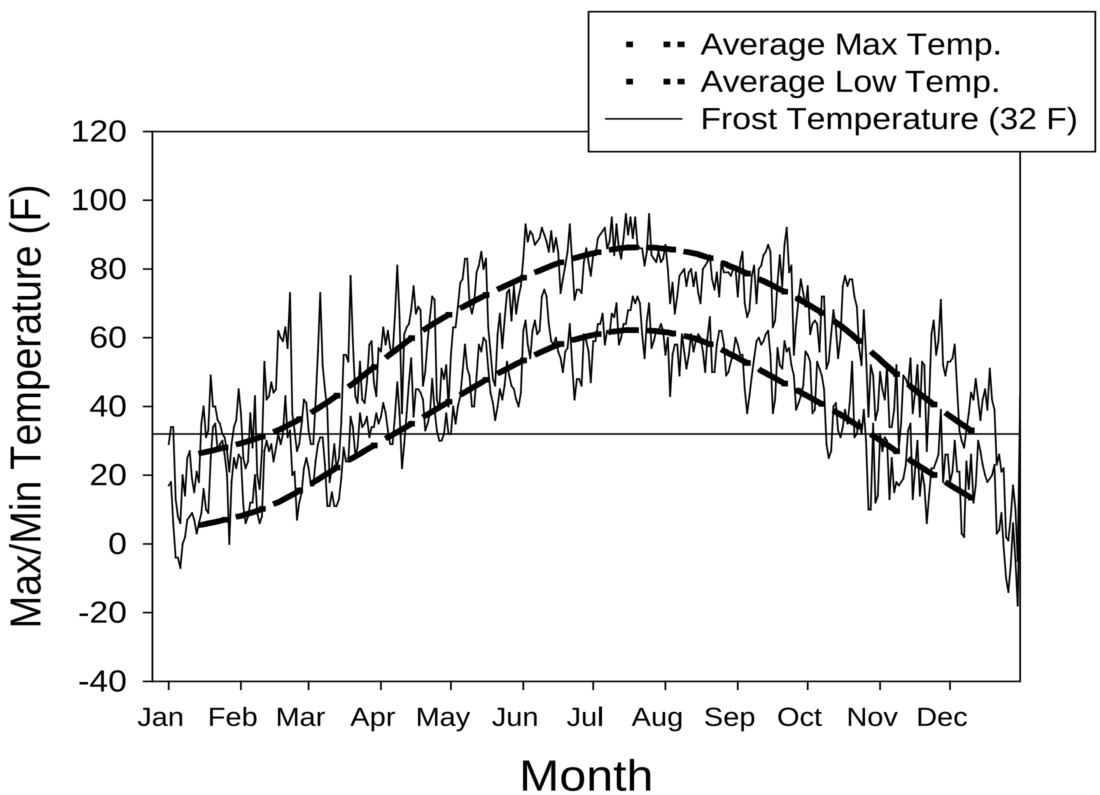


Figure 2. 2017 Monthly Precipitation; Southeast Farm, Beresford, SD

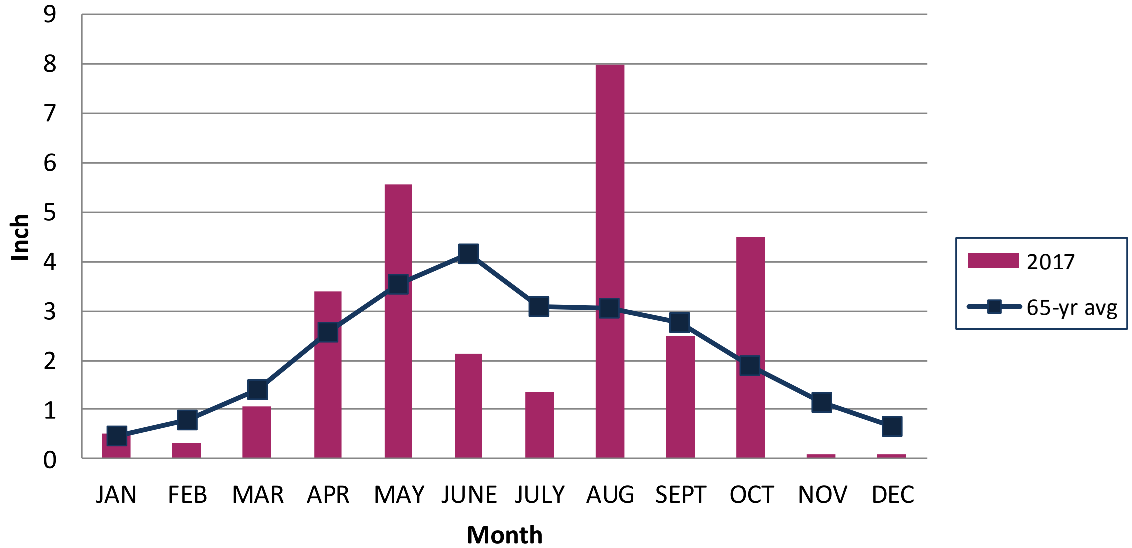


Figure 3. 2017 Cumulative Precipitation, Southeast Farm, Beresford, SD

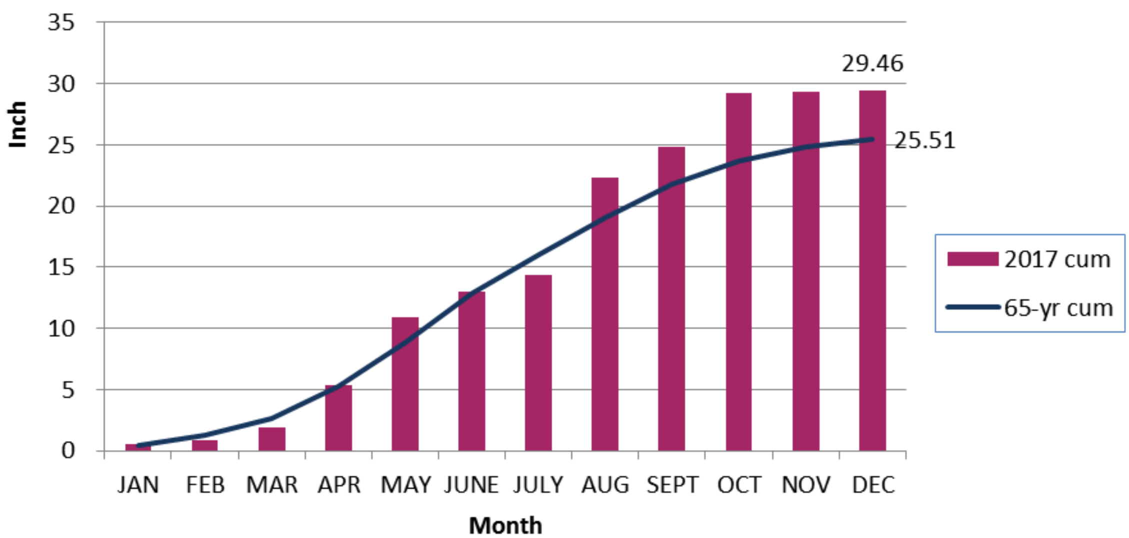


Figure 4. 2017 Growing Degree Units (GDU's); Southeast Farm, Beresford, SD

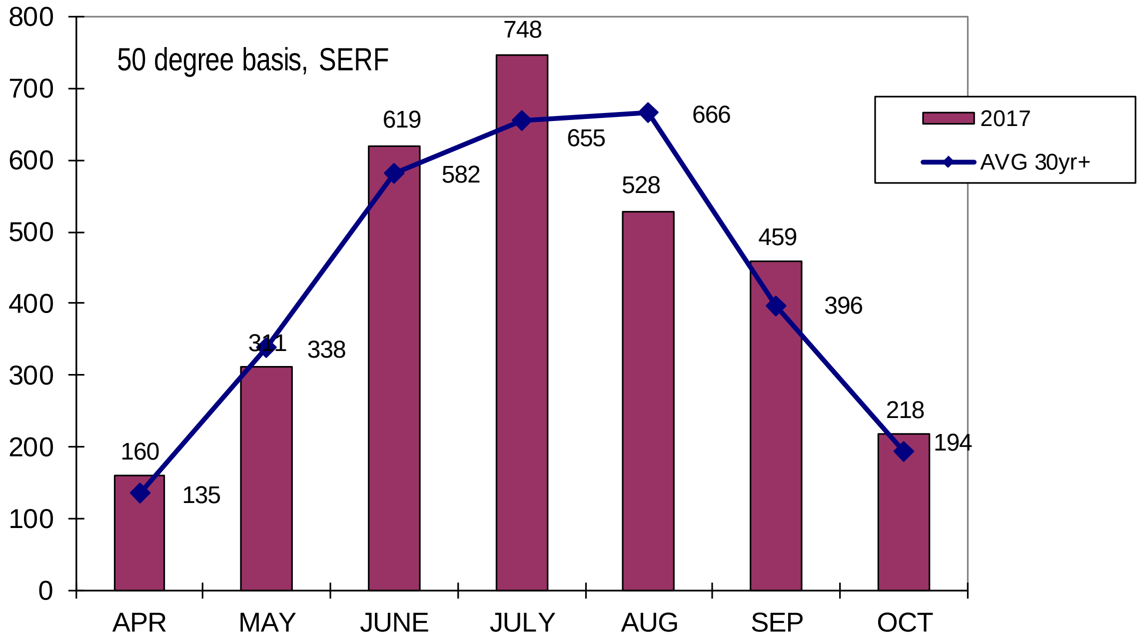


Figure 5. 2017 Cummulative GDU's; Southeast Farm, Beresford, SD

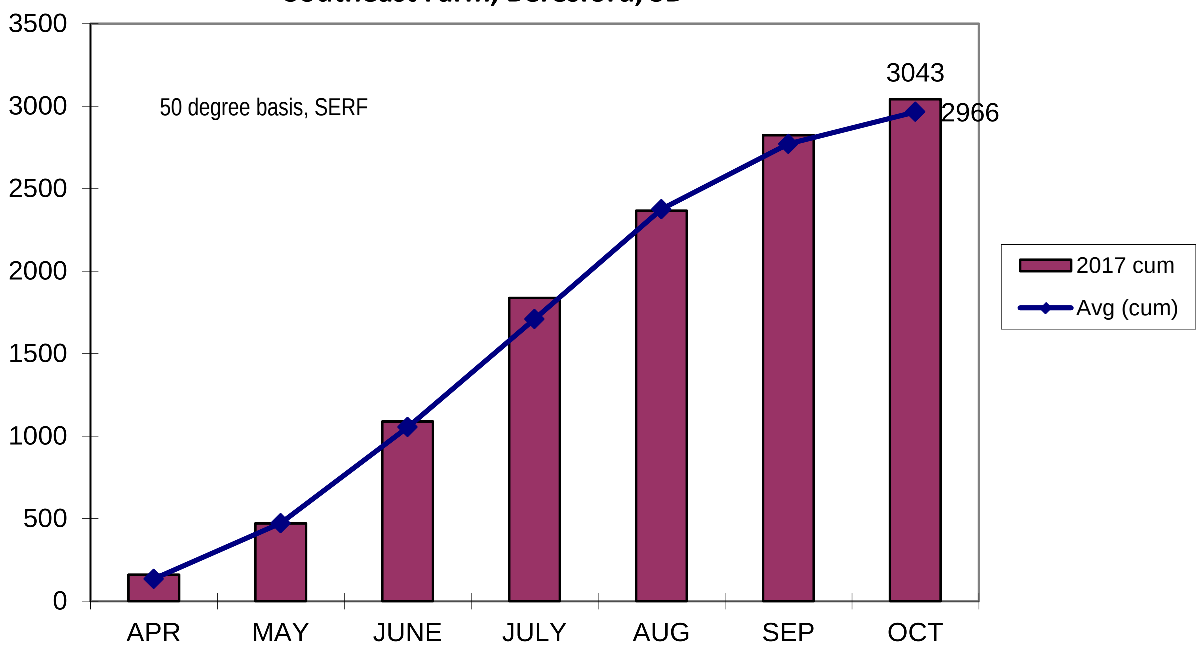


Figure 6. 2017 Growing Season
Rainfall vs. Evaporation
Southeast Farm

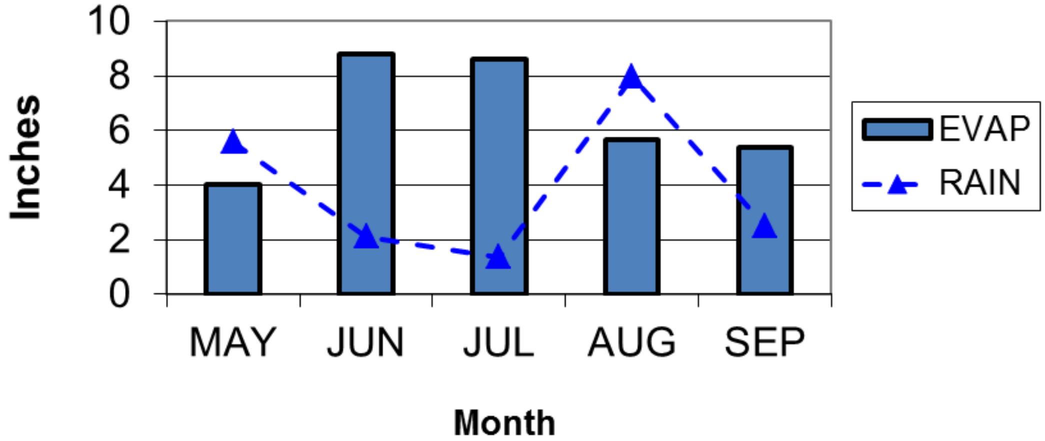
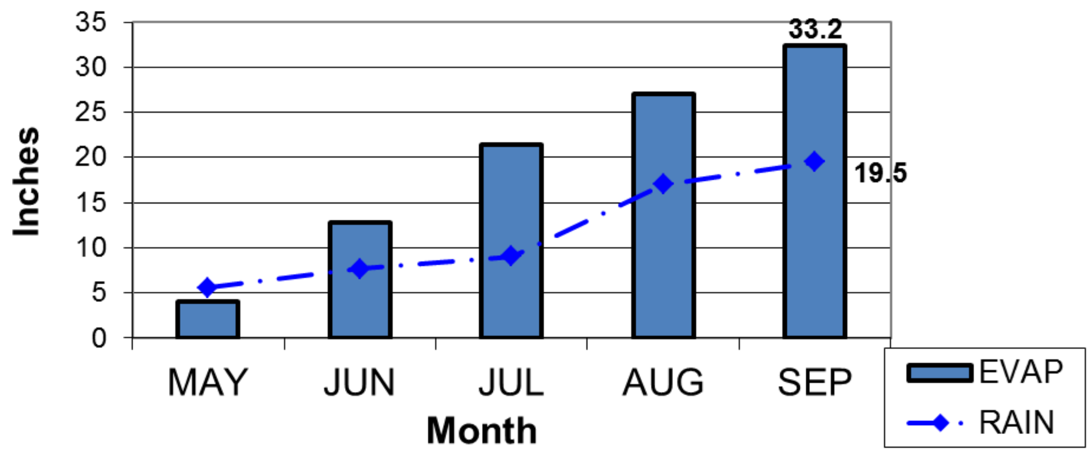


Figure 7. 2017 Growing Season
Cumulative Rainfall vs. Evaporation
Southeast Farm



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Comparison of Several Different Maturity Groups of Soybeans Planted after a Winter Rye Silage Crop - 2017 Season

Peter Sexton*, Duane Auch,
and Brad Rops

INTRODUCTION

Winter rye and winter triticale have potential as cool-season silage crops that might allow for harvesting three crops in two years. Winter rye in particular has strong winter hardiness and as such is a low risk forage crop that could be planted after corn harvest and harvested in early to mid-June. After the rye (or triticale) comes off, the field could then be planted to soybeans, thus producing three harvestable crops (corn/rye silage/soybeans) in two years. One question this raises is what maturity group of soybeans should be planted after a rye silage crop. With this in mind, a small plot study, with four different soybean lines differing in maturity, was seeded into a larger field that had been in a rye silage crop in order to see which maturity group best fits this type of system at Beresford.

METHODS

The rye silage crop was harvested 07 June, 2017. Soybeans were planted on 13 June, 2017 in 30” rows at a population of 150,000 seeds per acre. A forage sorghum treatment (‘BinBuster BMR’ sorghum) was also included in the trial in order to see what kind of tonnage that would provide if a farmer wanted to put in a second silage crop. Plots were 40’ long by 15’ wide (6 rows). Soybean yields were determined with a Kincaid Plot Combine (Model 2065) on 17 October, 2017. Forage sorghum yield was determined by hand harvest of 10’ of row from each plot on 4 October, 2017. Total fresh weight was measured, and then three plants were chipped for determination of percent moisture by drying a subsample at 140˚ F in a forced air dryer for 6 days.

RESULTS

Soybean yields averaged 60 bu/ac across all the treatments. There were no significant differences in yield among the lines tested; although there was a trend for the later maturity lines to show a little more yield than the early maturity lines (Table 1). The forage sorghum line yielded 6.4 tons per acre on a dry matter basis, and 18.3 tons per acre of silage on a 65 % moisture basis. On a whole field basis we obtained a rye tonnage of 3.81 tons per acre of silage with minimal inputs. This system looks promising at this point. Although much will depend on June rainfall, in this case moisture was sufficient to get the bean crop established and with plentiful rain in August good yields were obtained. With a June 12 planting date the 2.5 maturity group line yielded 62.8 bushels per acre. Since this system looks like it has good potential, we will probably put more effort into identifying best management practices for the

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winter cereal silage crop to maximize yield and quality from that part of the system.

ACKNOWLEDGEMENT

The authors appreciate the contributions of the South Dakota Agricultural Experiment Station to support this project.

Table 1. Stand, percent moisture, test weight, 100-seed weight and grain yield from soybeans of different maturity groups sown after a rye silage crop at the Southeast Research Farm in Beresford, South Dakota. The rye was harvested on – June and the soybeans were planted on June 12, 2017. Soybeans were harvested on --- October, 2017.

Line	**Stand**	**Moisture**	**Test Wt.**	**100-Seed Wt.**	**Yield**
	(plants/ac)	(%)	(lb/bu)	(g)	(bu/ac)
P25T51R	109626	11.8	55.7	19.4	62.8
P28T08R	110352	14.0	55.2	19.7	61.2
P18T26R	122694	10.0	55.2	16.1	59.6
P22T69R	119427	10.3	55.5	17.9	57.8
Mean	*115520*	*11.5*	*55.4*	*18.2*	*60.3*
CV (%)	*5.4*	*13.2*	*2.1*	*2.8*	*4.2*
LSD (0.10)	*8080*	*2.0*	*NS*	*0.7*	*NS*

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Oat Response to Applied Nitrogen – SDSU Southeast Research Farm, 2017 Season

Peter Sexton[*], Duane Auch, Brad Rops, David Karki, and Anthony Bly

INTRODUCTION

Oats (*Avena sativa*) have historically been a very important crop in South Dakota, although in recent years oat cultivation has declined and largely moved to the prairie provinces of Canada. Newer lines of oats released by SDSU and nearby states have shown increased yield potential up to and exceeding 160 bushel per acre on a field scale. At the same time, there is a market segment that is interested in locally produced oats – this combination of factors has improved the economics of oat production to some extent. Given the increased interest in oats and the development of new lines, it was decided to evaluate the response of oats to N at the Southeast Farm to help guide farmers in how much N fertilizer to apply to this crop.

METHODS

'Horsepower' oat was direct seeded into corn stubble on 08 April, 2017 at a seed rate of 80 lb per acre at the Southeast Research Farm at Beresford, SD. Initial soil nitrate at this site was 32 lb per acre to a depth of 24". Nitrogen was applied as urea at rates of 0, 30, 60, 90, 120, and 150 lb N per acre by hand on 05 April, 2017. Individual plots were 20' by 30' in size and were laid out in a randomized complete block design with four replications. Percent stand, chlorosis, and vigor (0 to 5 scale) were visually rated on 24 May, 2017. A foliar fungicide was applied 15 June, 2017. Plots were harvested 4 August, 2017 by a Kincaid Plot Combine (Model 2065) and grain yield, moisture, and 100 seed weights were determined. Data was subjected to standard ANOVA using Proc GLM in SAS statistical software.

RESULTS

Stands were good across all the plots and no insect or disease issues were observed in these plots. Yield did not respond to applied N greater than 60 lb/ac (Table 1). Test weights were all greater than 38 lb/bushel. Individual plot yields were plotted against applied N rate to show the shape of the N response (Fig. 1). Fitting this data to a quadratic plateau model, the estimated optimum amount of applied N in this study was 52 lb N per acre. Given that the measured soil nitrate level was 32 lb N/ac, the estimated total N for this treatment would have been 84 lb N per acre. With an average yield of 117 bu/ac for the better treatments, this calculates to a ratio of 0.7 lb N per bushel. To compare this with some field level data, in 2015 the farm average yield for oats was 142 bu/ac and the average total N (applied plus soil nitrate) was 111 lb N per acre, giving a ratio of 0.9 lb N per acre. More work needs to be done in this area, but these

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observations would suggest that using a ratio of 0.8 lb N per bushel minus N credits would not be far off the mark for guiding N application in oats.

ACKNOWLEDGEMENT

The authors appreciate the contributions of the South Dakota Agricultural Experiment Station to support this project.

Table 1. Moisture, test weight, percent stand, chlorosis, vigor, and grain yield observed for 'Horsepower' oat under a range of applied N rates at the Southeast Research Farm in Beresford, SD, in the 2017 growing season. Initial soil nitrate level was 32 lb./ac to a depth of 24".

Nitrogen Rate	Moisture	Test Wt	Stand	Chlorosis	Vigor	Grain Yield
(lb./ac)	(%)	(lb/bu)	(%)	(%)	(0 to 5)	(bu/ac)
0	12.0	38.9	91.3	17.5	2.5	70.5
30	12.2	39.4	87.5	8.3	4.0	107.1
60	12.1	38.6	91.3	0.0	4.3	115.9
90	11.8	38.3	92.5	0.0	4.3	114.9
120	12.1	38.6	92.5	0.0	4.0	121.3
150	12.0	38.5	90.0	1.3	4.0	115.9
Mean	*12.0*	*38.7*	*90.8*	*4.5*	*3.8*	*107.6*
CV (%)	*2.0*	*1.4*	*3.1*	*141.0*	*12.0*	*7.2*
LSD (0.10)	*NS*	*0.7*	*NS*	*7.9*	*0.6*	*9.6*

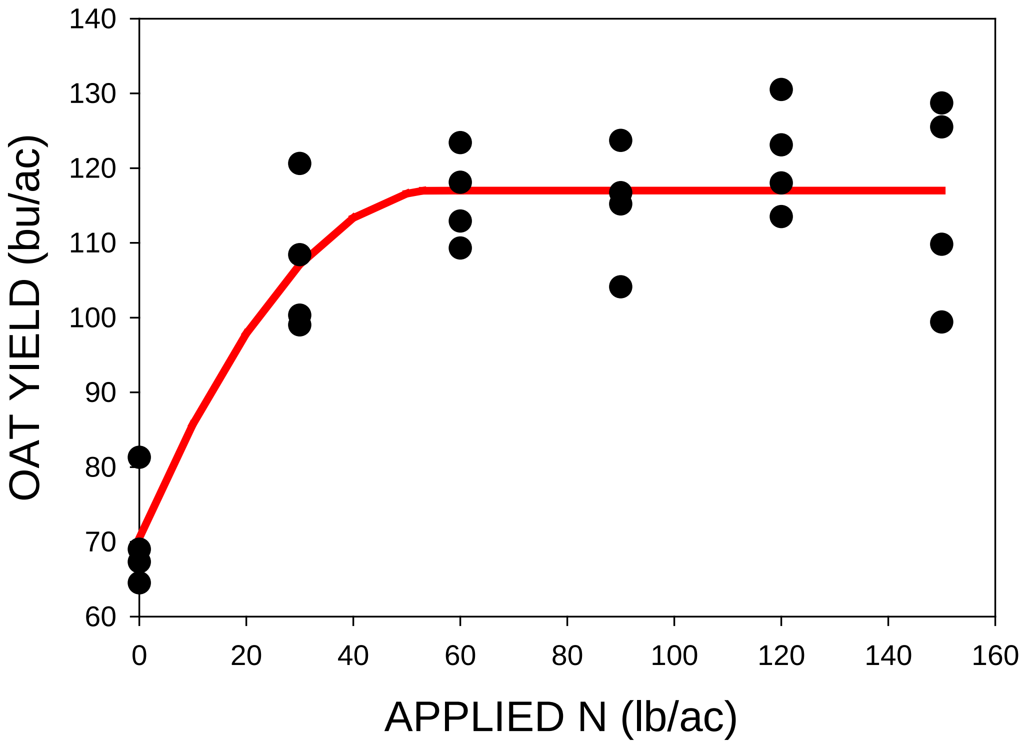

Fig. 1. Oat grain yield versus applied N rate in a study conducted at the Southeast Research Farm in Beresford, SD, in 2017. Data are from individual plots in a randomized complete block design with four replications for rates of 0, 30, 60, 90, 120, and 150 lb. N per acre.

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Yield Response of Soft White Winter Wheat to Applied Nitrogen in Southeast South Dakota

Peter Sexton[*], Duane Auch,
Anthony Bly, and Brad Rops

INTRODUCTION

Soft white winter wheat (*Triticum aesitivum*) is a class of wheat not traditionally raised in South Dakota. The main issue with this crop, if it is ever to be raised in this area, will be marketing. Nevertheless, as a preliminary step in looking at this crop it was decided to run a N response trial to help determine appropriate N rates for its cultivation. While much work has been done with fertilizer management of hard red winter wheat in our region, there is no history of soft white winter wheat production here, so this seemed like a good place to start.

METHODS

The soft white wheat line 'SY 901' was direct seeded into oat stubble at a rate of 120 lb per acre on Sept. 20, 2016. The plot area was split into two trial areas that were run side by side. One set of plots received 20 lb of N per acre in the fall as UAN. The adjacent plot area did not receive any fall N. Soil nitrate to a depth of 24" was 26 lb/ac as sampled on 28 March, 2017 in an adjacent plot that did not have winter wheat on it. Consistent with this, fields following oats on other parts of the farm tested about 24 lb/ac nitrate-N to a depth of 24". In the spring each trial area was divided into small plots and treatments of 0, 35, 70, 105, 140, and 175 lb N per acre were applied as urea in a randomized complete block design with four replications in each trial. Plot size was 20' by 30' in the area that received 20 lb/ac fall N, and plot size was 30' by 30' in the area that only received spring applied N. Yield was determined from each plot using a Kincaid Plot Combine (Model 2065).

RESULTS

Data on grain moisture, test weight, yield, and lodging for each trial are given in Table 1 (no fall N application) and in Table 2 (20 lb per acre of N applied in the fall). Pooled yield data from both trials is shown in Figure 1. The N response for the two trials fell along a similar response curve as shown in Figure 1. Yields from the plots that received their entire N in the spring did not appear to suffer from missing the 20 lb N application in the fall. Based on the quadratic-plateau "best fit" line, the response to applied N peaked at 107 lb of applied N per acre in this environment. Given an initial soil nitrate level of 26 lb N/ac, the estimated available N for this crop at the peak response would be 133 lb N/acre (26 plus 107 lb N/ac) in this trial. With an observed yield of 107 bu/ac, this corresponds to a ratio of about 1.2 lb N per bushel of yield goal minus soil nitrate and other credits as a first-cut preliminary estimate of N requirements for soft white wheat in southeastern South Dakota.

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Table 1. Response of 'SY 901' soft white winter wheat to applied N in the spring in the 2017 growing season at the Southeast Research Farm in Beresford, South Dakota. No nitrogen was applied in the fall on these plots. Lodging was visually scored on a 1 to 10 scale (10 being totally lodged) on July 18, 2017.

Spring Nitrogen Rate	**Moisture**	**Test Wt.**	**Yield**	**Lodging Score**	**NIR Grain Protein**
(lb/ac)	(%)	(lb/bu)	(bu/ac)	(1 to 10)	(%)
0	12.3	57.5	73	1.0	9.8
35	12.4	58.0	94	1.0	9.7
70	12.3	58.4	103	1.0	8.7
105	12.0	59.0	106	1.5	10.4
140	11.9	58.5	108	2.5	8.7
175	11.7	58.5	116	3.5	10.7
Mean	*12.1*	*58.3*	*100.0*	*1.75*	*9.7*
CV (%)	*1.7*	*1.7*	*7.4*	---	---
LSD (0.10)	*0.3*	*NS*	*9.1*	---	---

Table 2. Response of 'SY 901' soft white winter wheat to applied N in the spring in the 2017 growing season at the Southeast Research Farm in Beresford, South Dakota. These plots all received 20 lb per acre of N in the previous fall (2016). Lodging was visually scored on a 1 to 10 scale (10 being totally lodged) on July 18, 2017.

Spring Nitrogen Rate	**Moisture**	**Test Wt.**	**Yield**	**Lodging Score**	**NIR Grain Protein**
(lb/ac)	(%)	(lb/bu)	(bu/ac)	(1 to 10)	(%)
0	12.3	57.8	75	1.3	7.9
35	12.3	58.7	98	1.5	8.5
70	12.3	59.2	106	1.5	8.5
105	12.1	58.8	108	1.3	9.2
140	11.8	59.0	103	2.5	10.3
175	11.8	58.7	98	3.5	11.0
Mean	*12.1*	*58.7*	*97.9*	*1.93*	*9.2*
CV (%)	*1.8*	*1.2*	*7.9*	---	---
LSD (0.10)	*0.3*	*NS*	*9.6*	---	---

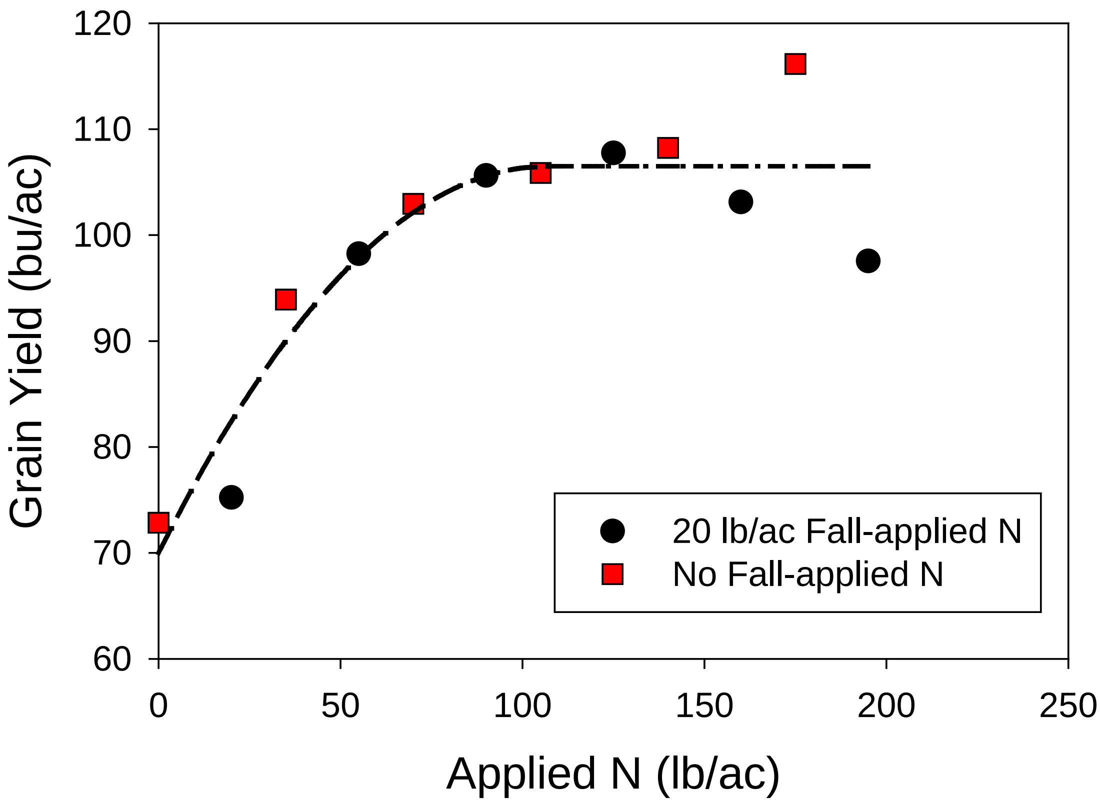

Fig. 1. Grain yield of ‘SY 901’ soft white winter wheat versus rate of applied N from two trials conducted at the SDSU Southeast Research Farm in Beresford, South Dakota, in the 2017 growing season. The data points are pooled from two studies, one where no fall N was applied, and a second where 20 lb of N was applied in the fall. A quadratic-plateau model was fit to the pooled data set and is shown as a dashed line on the graph. The model predicts that yield will plateau at 107 bu/ac with an applied N rate of 107 bu/ac. This trial was planted on oat stubble on Sept. 20, 2016.

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Alfalfa Variety Trial at the Southeast Research Farm – 2017 Season

Sara Berg, Karla Hernandez,
Peter Sexton,* and Brad Rops

INTRODUCTION

Alfalfa is an important crop for most ruminant nutrition, and it is critical for profitable dairy production. South Dakota ranks third in the nation, behind California and Idaho, in alfalfa production with approximately 1.7 million acres harvested in the state in 2016 (USDA-NASS, 2017). Variety selection is an important component of profitable alfalfa production. The following is a report on yields observed in an alfalfa variety trial being conducted at the SDSU Southeast Research Farm. This is the second year of a small plot study with 21 lines.

METHODS

The plots were laid out in a randomized complete block design with four replications. Plot size is 4' by 25'. Plots were fertilized with 180 lbs/ac potash (KCl) 06 April, 2017. Plots were end-trimmed to approximately 20' length and plot lengths recorded immediately before harvest and then whole plot yields were taken using a forage harvester (Model SMW-SCH-48; Swift Machine & Welding, Swift Current, Saskatchewan, Canada) at approximately 4 week intervals: 22 May, 19 June, 20 July, and 23 August, 2017. Subsamples of fresh material were weighed and dried at 140˚ F to determine percent moisture. All yield data are presented on a dry weight basis. Because of rainfall during the winter, alfalfa stands were damaged in a swale in the plot area. To track this, in late April the plots were visually rated for stand and vigor on a 0 to 10 scale; all plots that were rated less than 7 for either stand or vigor were excluded from the yield analysis for the rest of the year. Data was subjected to standard ANOVA. Where treatment effects were statistically significant ($P < 0.10$), the means were individually compared to the highest yielding line for that cutting and separated with an LSD test ($P < 0.10$) using SAS statistical software, taking into account missing points for each comparison.

RESULTS

As mentioned above, on December 25, 2016 there was a thaw and rainfall of 0.88 inches followed by freezing weather. This damaged the alfalfa stand in part of the trial area. Yield data for each cutting and total 2017 production, as well as 2016 total production are shown in Table 1. Note that data from damaged plots (rated less than 7 for stand or vigor in April) were not included in the analysis for 2017. Average yield over the season for these plots was 5.92 tons per acre on a dry matter basis, ranging from 4.61 to 7.29 ton/ac. As for precipitation, the season began with a wetter than average spring and went into a mild drought in July and early

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August (see 2017 Weather Summary AR 1701). There was grasshopper pressure noted in the plots before the third cutting; however, they tended to leave the field after it was cut and no insecticides were applied. This trial will be maintained and further yield data collected in the 2018 growing season.

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Authors thank the SDSU Southeast Research Farm at Beresford for all the technical help with this project and for the contributions of the South Dakota Agricultural Experiment Station to support this project.

Table 1. Forage yield on a dry matter basis during the second year of growth (2017 season) for 21 lines of alfalfa evaluated at the SDSU Southeast Research Farm, Beresford, SD. Data are based on whole plot (4' by 20') yields in a replicated trial. Harvest dates were 22 May, 19 June, 20 July, and 23 August, 2017. Variety effects were statistically significant (P<0.10) for the second and third cuttings, and for the season total yield – all means followed by the letter "a" are not statistically different (P<0.10) from the highest yielding line for that column. For the reader's interest, a set of LSD values calculated with three replications, or for missing data, is shown at the bottom of the table.

Line	Source	First Cut	Second Cut		Third Cut		Fourth Cut	2017 Total		*2016 Total*	
		(ton/ac)	(ton/ac)		(ton/ac)		(ton/ac)	(ton/ac)		*(ton/ac)*	
Leyenda	Legend Seeds	2.39	**1.81**	**a**	**1.51**	**a**	1.59	**7.29**	**a**	***2.38***	***a***
8420	Wilbur Ellis Company	2.22	**1.67**	**a**	**1.48**	**a**	1.68	**7.06**	**a**	***2.56***	***a***
FSG 426	Farm Science Genetics	2.24	**1.70**	**a**	**1.54**	**a**	1.33	**6.81**	**a**	*2.24*	
AFXH143146	Dairyland	2.38	**1.48**	**a**	**1.41**	**a**	1.51	**6.78**	**a**	***2.43***	***a***
GA-497 HD	Preferred Alfalfa Genetics	2.31	**1.49**	**a**	**1.37**	**a**	1.41	**6.57**	**a**	***2.40***	***a***
GA-409	Preferred Alfalfa Genetics	2.30	**1.47**	**a**	**1.32**	**a**	1.36	**6.46**	**a**	***2.42***	***a***
Mustang 420+	Mustang Seeds	2.28	**1.55**	**a**	**1.33**	**a**	1.31	**6.46**	**a**	*2.17*	
8450	Wilbur Ellis Company	2.27	**1.38**	**a**	**1.24**	**a**	1.25	**6.14**	**a**	***2.30***	***a***
4H400	Mycogen	2.08	1.31		**1.23**	**a**	1.37	**5.99**	**a**	***2.46***	***a***
HybriForce-3420/Wet	Dairyland	2.33	1.28		1.08		1.25	**5.93**	**a**	***2.58***	***a***
Robin	Blue River Hybrids	2.29	1.30		1.13		1.09	5.81		*2.28*	
HybriForce-3430	Dairyland	2.23	1.20		1.13		1.18	5.74		*2.08*	
Bobolink	Blue River Hybrids	2.16	1.19		1.12		1.26	5.74		*2.29*	
FSG 415 BR	Farm Science Genetics	2.28	0.96		1.09		1.24	5.58		***2.36***	***a***
8444R	Wilbur Ellis Company	1.92	1.32		1.09		1.17	5.51		*2.14*	
FSG 423ST	Farm Science Genetics	2.09	1.19		1.09		1.14	5.50		***2.44***	***a***
Mustang 620 Aph 2	Mustang Seeds	2.10	1.20		1.00		1.08	5.38		*1.95*	
AFXH144110	Dairyland	2.09	1.14		0.94		1.05	5.21		***2.36***	***a***
Roadrunner	Blue River Hybrids	2.04	1.18		0.98		1.01	5.20		*2.09*	
DG 4210	Dyna-Gro	1.89	0.99		0.89		0.88	4.66		*1.96*	
FSG 403LR	Farm Science Genetics	2.07	0.88		0.80		0.87	4.61		*2.16*	
Means		*2.18*	*1.32*		*1.18*		*1.24*	*5.92*		2.29	
P-value		*NS*	*<0.05*		*<0.10*		*NS*	*<0.10*		*<0.05*	
CV (%)		*10.5*	*21.9*		*24.1*		*24.4*	*17.2*		10.5	
LSD (0.10)		*NS*	*0.44*		*0.39*		*NS*	*1.39*		0.29	

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Burndown Timing For a Rye Cover Crop Raised Ahead of Corn – A Preliminary Study

Peter Sexton*, Duane Auch,
and Brad Rops

INTRODUCTION

Because of its benefits for soil health and its rugged ability to overwinter, use of rye as a cover crop is expanding in corn/soybean cropping systems. This raises questions of the optimum burndown timing ahead of planting the main crop. Delaying burndown allows the rye to put on more biomass and capture more energy to benefit soil health. At the same time, the rye cover crop is using soil moisture and taking up nutrients, particularly N, that may be sequestered from the following crop. Depending on conditions, allowing the rye to grow longer may limit availability of moisture and nutrients for the next crop. Soybeans fix their own N, and for this reason are relatively tolerant of being "green-planted" into a rye cover crop; however, work done in 2016 at the Southeast Farm showed decreased S levels on a whole plant basis where soybeans were green-planted into rye versus where the rye had been burned down three weeks before planting. Because of this it was decided to do further work to look at burndown timing with rye raised ahead of corn, as a more sensitive crop, and look at the effects of adding supplemental N and S with green planting in contrast to a preplant burndown applied two weeks ahead of planting.

METHODS

Rye was direct seeded into soybean stubble on October 31, 2016. Plots that were to have a preplant burndown were sprayed with glyphosate on May 16, 2017, and the whole field was sprayed with a burndown herbicide (glyphosate with metolachlor) on May 31, and the field was planted to corn (P9917R) on June 2. Figure 1 shows plots at the time of planting. Four supplemental fertilizer treatments were tested with green-planting: no supplemental fertilizer, 20 lb per acre of N surface banded at planting 2" from the row, 20 lbs of S broadcast as $MgSO4\text{-}K_2SO_4$, and a combination of both supplemental N and S. Plot size was 15' by 45' laid out in a randomized complete block design with three replications - later the rep along the field edge was dropped, so the data on yield is limited to two replications. To obtain a 'snapshot' estimate on the amount of nutrients present in the remains of the cover crop, the rye residue was sampled on June 19 from each plot (6 square feet per plot), dried, and analyzed for nutrient content. Grain yield was determined using a Kincaid Plot Combine (Model 2065).

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RESULTS

Rye grows very rapidly in late May in our environment. Allowing the rye to grow an extra two weeks resulted in an increase in residue from 1300 to 3060 lb per acre as measured on June 19, 2017 – an increase of 190 % (Table 1). This also resulted in larger amounts of N, K, and S, being retained in the rye residue at the June 19 sample date (numeric difference of approximately 40 lb per acre for N and K, and 3 lb per acre for S between the preplant burndown and green plant treatments). More in-depth and more expensive research will need to be done to determine how much of this N, K, and S would become available to the corn crop later in the season. Nevertheless, it is clear that allowing just two weeks more growth for rye in late May results in a large change in residue levels and in nutrients retained in nutrients during early season growth. There was a trend for about a 15 bu/ac yield loss with green planting in this study, which supplemental fertilizer did not appear to ameliorate; however, with only two replications of yield data in this preliminary study, none of the differences were statistically significant. The trend for lower yield with S supplementation is interesting and suggests that the choice of material used needs some more thought and consideration. In this trial supplemental fertilizer did not help to bridge the yield gap between preplant burndown versus green-planting – which suggests that either other mechanisms are at work behind the yield decline, or else that higher rates of N supplementation or better placement are needed to bridge this gap. We hope to carry this work forward in 2018.

Fig. 1. Photo of two rye burndown plots at the time of corn planting (June 2, 2017) in a trial at the Southeast Research Farm in Beresford, South Dakota. The plot to the right was sprayed out two weeks ahead of planting, and the plot to the left was sprayed out 2 days ahead of planting.

Table 1. Observed nutrient content of rye residue on June 19, 2017 under a corn canopy. Preplant burndown was done on May 16th. The 'Green-plant' treatment was sprayed on May 31st and the field planted to corn on June 2nd. Samples were taken from two samples per plot (3 square feet per sample), dried, weighed, chopped and subsampled for nutrient analysis for the two treatments.

Burndown Treatment	Dry Matter	N	P	K	S
	(lb/ac)	(lb/ac)	(lb/ac)	(lb/ac)	(lb/ac)
Preplant Burndown	1300	28.6	2.21	32.4	2.08
Green-plant	3060	69.7	6.42	73	5.19

Table 2. Stand at harvest, grain moisture, test weight, and yield for corn grown seeded into a rye cover crop. One set of plants was sprayed out two weeks before planting (May 16, 2017), while the other set was green-planted having been sprayed on May 31, and then planted on June 2, 2017. Four supplemental fertilizer treatments were tested with green-planting: no supplemental fertilizer, 20 lb per acre of N surface banded at planting 2" from the row, 20 lbs of S broadcast as MgSO4, and a combination of both supplemental N and S.

Burndown	Supplemental Fertilizer	Moisture	Test Wt	Stand	Yield
		(%)	(lb/bu)	(plants/ac)	(bu/ac)
Preplant	none	19.6	54.4	31,218	164.4
Green Plant	none	20.4	53.3	29,766	150.3
Green Plant	+N	19.7	54.1	31,218	148.3
Green Plant	+N +S	20.6	52.8	29,766	140.5
Green Plant	+S	20.4	53.2	32,670	139.7
	Mean	*20.1*	*53.5*	*30,928*	*148.6*
	CV (%)	*4.3*	*2.5*	*3.6*	*8.3*
	LSD (0.10)	*NS*	*NS*	*NS*	*NS*

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Preliminary Comparison of Broadleaf Versus Grass Based Cover Crop Blends on Yield of the Following Soybean Crop – 2017 Season

Peter Sexton[*], Duane Auch, and Brad Rops

INTRODUCTION

The effect of different cover blends (seeded after small grain harvest) on soybean grain yield is an area that needs more research. Here at the Southeast Farm, a number of studies have been conducted looking at impacts of contrasting cover crop blends on yield of the following corn crop and we have found on average an 11 bushel per acre yield gain in corn following a cool-season broadleaf blend versus no cover crop, or a grass-based cover crop, in our environment. As a preliminary step in this regard, it was decided to compare a grass-based versus a broadleaf-based cover crop mix on yield of the subsequent soybean crop.

METHODS

Pairs of contrasting cover crop blends (one 85 % grasses, and the other 75 % broadleaves) were direct seeded into winter wheat stubble on July 18, 2016. The proportions and amounts of the species in each blend are shown in Table 1. Plot size was 30’ by 90’ and plots were laid out in a randomized complete block design with four replications. The whole field was grazed in November of 2016. The field was no-till seeded to soybeans (blend of P18T26R2 and P19T784) at seed rate of 150,000 seeds per acre with a John Deere 750 no-till drill on June 9, 2017. One replication was dropped because a portion of it suffered from excessive moisture due to heavy rains in May and June of 2017. Soybean yields were determined using a Kincaid Plot Combine (Model 2065) on October 13, 2017.

RESULTS

No significant differences were observed in soybean yield following the contrasting cover crop blends. The average yield in the trial was 58 bushels per acre and all the treatments were within 1.5 bushels of this in yield. Last year (2016) in a study with different cover crop blends on a field with heavy SCN pressure, we observed a trend for better yield with a heavy brassica component in the cover crop – particularly mustard and radish. In this season (2017) the broadleaf blend, which was 50 % brassicas, had a slightly numerically higher yield, but was not really distinguishably different from the control. In the 2017 trial, the field was in a lower part of the research farm and we had a very wet conditions at the beginning of the season – it may be that in this location the broadleaf cover crop left the surface

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a little more open so it could dry better and may have benefitted crop health, but that is speculative. Another point to consider here is that the whole area was grazed in November of 2017. This may have evened out the treatments somewhat. In any case, we did not observe a response of soybeans to broadleaf versus grass based cover crop blends in this experiment.

Table 1. The proportion and amount of each species used in the grass and broadleaf based blends seeded into winter wheat stubble in 2016.

Grass Blend Cover Crop Species	Proportion	Seed Rate	**Broadleaf Blend** Cover Crop Species	Proportion	Seed Rate
	(%)	lb/ac		(%)	lb/ac
Oats	25	17.5	Radish	30	2.4
Sorghum/sudan	25	6.3	Oats	15	10.5
Barley	20	15.0	Lentil	10	2.0
Teff	15	0.8	Teff	10	0.5
Turnip	10	0.3	Turnip	10	0.3
Radish	5	0.4	Winifred Brassica	10	0.4
Winifred Brassica	5	0.2	Winter Pea	10	6.0
Winter Pea	5	3.0	Flax	5	1.3

Table 2. Stand, percent moisture, test weight, seed weight, and grain yield for soybeans seeded in 2017 after contrasting cover crop treatments from the fall of 2017. Note the whole field was grazed in November of 2017.

Cover Crop	Stand	Moisture	Test Wt.	100-Seed Wt.	Yield
	(plants/ac)	(%)	(lb/bu)	(g)	(bu/ac)
Broadleaf	128744	11.1	57.1	17.3	59.3
Control	137456	11.0	56.7	17.6	58.4
Grass-based	135520	11.4	54.8	16.9	57.2
Mean	*133910*	*11.2*	*56.2*	*17.3*	*58.3*
CV (%)	*17.2*	*2.4*	*2.4*	*2.8*	*4.2*
LSD (0.10)	*NS*	*NS*	*NS*	*NS*	*NS*

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Long-Term Rotation Study: Observations on Corn and Soybean Yields – 1991 to 2016

Peter Sexton*, Duane Auch, Brad Rops, Ruth Stevens, Doug Johnson, Garold Williamson, and Sandeep Kumar

INTRODUCTION

In 1991 Dale Sorensen initiated a long-term rotation study at the Southeast Farm including comparison of no-till and conventional till under two year (corn-soybean), three year (corn-soybean-small grain or field pea) and a flex rotation (currently corn-soybean-oat-winter wheat) – note the three year and flex rotations have not been constant over the years. The advantages of no-till are many: residue on the surface protects the soil from erosion; it helps to maintain soil organic matter which is important for good tilth; conserves moisture and limits run-off; requires fewer trips across the field. The disadvantages are the loss of tillage as a tool for weed control and slower warming of the soil in the spring. This report provides a short analysis of corn and soybean yield data from the beginning of this trial through the 2016 season. Data from 2017 is not included in this analysis as tile lines were installed along the north and south sides of each block in late spring of this year which delayed planting and made field operations awkward – making data from this season not fully representative of the treatments imposed. We anticipate continuing the trial and reporting results in coming seasons. While the rotation component of the trial has varied over the years, the tillage component has not. Therefore this report will discuss the tillage data from this trial more than the rotation element.

METHODS

As mentioned earlier, this set of plots was first established in 1991. The two year corn-soybean rotation has been consistently followed. The three year rotation started with corn, soybean, small grain and then for several years field pea was substituted for small grains, and then it was later switched back to a corn-soybean-small grain pattern. The four year or flex rotation initially included alfalfa, then after some years was changed to include peas, and later was changed again to include two soybean crops (corn-soybean-winter wheat-soybean), which was the case until the 2013 season. Since 2013 the flex rotation has been in a corn-soybean-oat-winter wheat sequence. For this reason the four year rotation is referred to as a 'Flex' rotation in this report. Two seasons were dropped from this data set: in 1993 no crops were planted due to excessive moisture; in 2005 the initial herbicide application for burning down weeds was applied late (well after planting), therefore data from this season was not included in the statistical analysis.

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This trial is laid out in a randomized complete block design with four replications. Plot size is 60 by 300 feet. The no-till plots, as their name implies, have not been tilled since the trial began in 1991. The tilled plots have been chisel plowed in the fall following harvest of corn and small grains, and worked in the spring with a field cultivator. Where wet conditions in the fall prevented chisel plowing corn stubble, the tilled plots were disked in the spring and then field cultivated.

Yield was measured from the center 30’ of corn plots and from the center 20’ of soybean plots, running the whole length of the plot; this was combined and the weight determined with a weigh wagon. A sample was kept for determination of moisture and test weight. Data was analyzed as a split plot design (main plots being rotation and tillage being the sub-plot; note each sub-plot is 60’ by 300’ in size) for corn and soybean yields using the Proc GLM routine in SAS statistical software. When the corn yield data was analyzed across 25 seasons of data, there were statistically significant interactions on all levels (tillage by rotation, tillage by year, year by rotation, and tillage by rotation by year). For soybeans, there were significant year by rotation, and year by tillage, interactions. It is beyond the purpose of the current report to delve into all the possible interactions and the factors involved in the corn and soybean yield data – that will have to be the subject of a more academic paper, hopefully to be published in the near future. For farmers reading this report, the main question to be addressed is how average yields compared across time from the no-till plots versus the tilled plots in this trial, and was this difference (if any) statistically significant. To directly address this question on a practical level, average yields from the two tillage treatments were compared using a paired t-test, with each year treated as one observation.

RESULTS

Corn Yields. Comparing data across all the seasons from 1991 through 2016 for this trial, in the two year (corn:soybean) rotation corn in the tilled plots averaged 5.5 bushel per acre greater yield than did corn in the no-till plots; with a more diverse rotation there was no yield benefit observed with tillage in this trial (Table 1), and in fact corn in the no-till plots showed a small numeric yield advantage in the longer rotations (1.7 to 2.3 bu/ac, not statistically significant). Average yield across rotations showed essentially the same yield for the tilled and no-till plots.

Table 1. Average corn yields observed in a long-term trial conducted at the Southeast Research Farm in Beresford, South Dakota comparing tilled and no-till plots under three different rotations. Data are from 1991 through 2016. Note that while corn and soybeans were always part of each rotation, the other crops in the three year and flex rotations sometimes changed over the years.

Rotation	**No-till**	**Tilled**	**Average Difference** (no till minus tilled)	**P-Value**
	(bu/ac)	(bu/ac)	(bu/ac)	
2 Year	140.6	146.1	-5.5	< 0.05
3 Year	149.2	147.5	1.7	NS
Flex (4-year)	157.0	154.8	2.3	NS
Across Rotations	147.2	147.7	-0.5	NS

While the other crops in the rotation were changed at times over the course of the trial, corn was consistent over the years in the sense that it was always raised one time in each rotation cycle. So comparing data on corn yields for different rotations in this trial has some value. Looking at the yields in Table 1, it appears that crop rotation is more important in a no-till system than in a tilled system. The numeric difference in corn yield between the 2-year and 3-year rotations was 8.6 bu/ac under no-till management, but only 1.4 bu/ac under tillage in these plots. The numeric yield gain with corn raised once every four years (comparing the 2-year and the flex rotation), was 16.6 bu/ac under no-till, but only 8.7 bu/ac under tillage.

Soybean Yields. Soybeans appeared to respond well to no-till management and in these plots, on average across rotations, yielded 1.7 bu/ac more under no-till management than under tillage (Table 2). Looking only at the 2 year (corn:soybean) rotation, soybeans in the no-till plots on average yielded 1.4 bu/ac more ($P < 0.10$) than did soybeans raised with tillage. Soybeans in the 3 year rotation tended to yield 1.2 bu/ac more with no-till, and soybeans in the flex rotation showed a significant 2.6 bu/ac yield advantage with no-till production. So there was a consistent trend across rotations for soybean yield to be greater in the no-till plots than in the tilled plots in this trial.

Table 2. Average soybean yields observed in a long-term trial conducted at the Southeast Research Farm in Beresford, South Dakota comparing tilled and no-till plots under three different rotations. Data are from 1991 through 2016. Note that while corn and soybeans were always part of each rotation, the other crops in the three year and flex rotations sometimes changed over the years. In the flex rotation sometimes soybeans were raised twice in a four year period.

Rotation	**No-till**	**Tilled**	**Average Difference** (no till minus tilled)	**P-Value**
2 Year	47.1	45.7	1.4	< 0.10
3 Year	46.2	45.1	1.2	NS
Flex	49.8	47.2	2.6	< 0.05
Across Rotations	47.4	45.7	1.7	< 0.05

Changes in the sequence of the legume crops raised in this study does not allow for robust comparisons of the effect of different rotations on soybean yields. In the three year rotation, there was a period where another legume (field pea) was substituted for small grain in the rotation – this means there were two legumes raised in a three year period (corn / field pea / soybean). In the flex rotation there was a period where soybeans were raised twice in a four year cycle (corn / soybean / winter wheat / soybean). Because of this, the data from this trial does not allow for solid comparisons of soybean yields between rotations.

Information on corn, and soybean, yields for each year of the study are shown in Table 3, and Table 4, respectively, including significance levels for the main effects of tillage and rotation, along with tillage by rotation interactions. Parsing out the interactions and main effects for each year will be the subject of a future report.

DISCUSSION

This report reviews corn and soybean yield data from a tillage and rotation study conducted at the Southeast Research Farm in Beresford, South Dakota from 1991 through 2016. In the two year corn:soybean rotation, the tilled plots showed an advantage in corn yield of 5.5 bu/ac on average over the no-tilled plots, while the no-till plots showed an advantage of 1.4 bu/ac greater soybean yield than was observed in the tilled plots ($P < 0.10$). If we assume a 3:1 ratio of market value for soybean relative to corn, then 1.4 bushels of soybeans is worth the equivalent of 4.2 bushels of corn. This means that the net benefit of tillage in this study with a two year rotation would over the years average 1.3 bushels of corn per acre.

How does this compare with the cost of tillage? The University of Minnesota cost estimate for running a chisel plow is \$ 11 an acre; the cost of running a tandem disk is estimated at \$ 11 an acre; and the cost of running a field cultivator is estimated at \$ 6 an acre (Lazarus, 2017). The overhead cost of a 200 HP tractor is estimated at about \$ 7500 per year, and with 500 hours of annual use, the total cost of a 200 HP tractor is estimated at about \$ 37,000 per year (Lazarus, 2017). Of course the costs for each farmer's operation are different based on their own circumstances, but in this trial the cost of tillage was not worth the gain in corn yields observed.

When more diversity was added with a three year rotation, there was no corn yield advantage observed with tillage. Soybean yields were also not significantly different in the three year rotation; although there was a trend for 1.2 bushel per acre better yield with no-till. So the data from this trial indicates that with a longer rotation the cost of tillage would have been even less economically advantageous than in the two-year rotation.

There are several critical factors to consider for farmers considering adopting a no-till system. Among these are good distribution of crop residue behind the combine; extra N is needed for corn during transition to no-till; proper planter settings to get the seed to the desired depth while avoiding sidewall compaction; attention to weed control and adequate burndown in the spring. Some long-term practitioners of no-till strongly advocate banding fertilizer at planting. Diversification of the rotation is definitely a plus with no-till. Keep in mind that it takes several years for the soil biology to transition to a no-till system, so it is not a quick process. It may be best to start with one field and work with that until one is comfortable with no-till management, and then go forward from there.

ACKNOWLEDGEMENT

The authors appreciate the contribution of the South Dakota Agricultural Experiment Station to support this research.

Table 3. Average annual corn yields observed in a long-term trial conducted at the Southeast Research Farm in Beresford, South Dakota comparing tilled and no-till plots under three different rotations. Data are from 1991 through 2016. ‘CT’ refers to conventional tillage, and ‘NT’ refers to no-till. Note that while corn and soybeans were always part of each rotation, the other crops in the three year and flex rotations were not consistent over the years and the flex rotation sometimes included two soybean crops in a four year period.

YEAR	CT 2-Year	CT 3-Year	CT Flex	NT 2-Year	NT 3-Year	NT Flex	CT Average	NT Average	ALL Average	Tillage	Rotation	Tillage by Rotation
	(bu/ac)	(bu/ac)	(bu/ac)	(bu/ac)	(bu/ac)	(bu/ac)	(bu/ac)	(bu/ac)	(bu/ac)			interaction
1991	110.5	111.0	----	117.5	113.3	----	110.7	115.4	113.1	NS	NS	NS
1992	162.2	158.5	----	165.3	160.8	----	160.4	163.1	161.7	NS	NS	NS
1994	157.5	154.5	----	142.3	152.2	----	156.0	147.2	151.6	*	NS	+
1995	55.4	72.4	----	70.4	77.5	----	63.9	74.0	68.9	**	NS	+
1996	177.5	178.6	185.4	169.2	187.6	194.9	180.5	183.9	182.2	NS	NS	*
1997	130.4	126.1	123.8	117.1	121.0	123.2	126.8	120.4	123.6	NS	NS	NS
1998	149.8	166.4	164.7	154.6	173.1	168.9	160.3	165.5	162.9	+	*	NS
1999	98.1	112.1	102.0	110.7	119.1	123.9	104.1	117.9	111.0	**	NS	NS
2000	157.6	140.3	147.2	121.2	152.1	150.1	148.4	141.1	144.7	NS	NS	*
2001	134.0	148.6	145.4	143.9	146.9	150.8	142.6	147.2	144.9	NS	NS	NS
2002	123.5	97.5	95.8	98.4	97.5	115.9	105.6	103.9	104.8	NS	NS	+
2003	183.2	182.9	191.7	175.0	184.7	183.7	185.9	181.1	183.5	NS	NS	NS
2004	170.9	173.9	171.4	173.1	176.1	176.7	172.1	175.3	173.7	NS	NS	NS
2006	109.5	111.7	119.5	91.5	118.7	131.8	113.5	114.0	113.8	NS	*	NS
2007	113.6	114.8	121.9	106.2	125.8	135.6	116.7	122.5	119.6	NS	NS	NS
2008	150.7	155.5	139.5	151.9	174.5	160.2	148.5	162.2	155.4	NS	NS	NS
2009	211.8	212.8	218.1	205.1	200.5	200.2	214.2	201.9	208.1	**	NS	NS
2010	192.7	197.8	195.1	178.8	180.2	194.8	195.2	184.6	189.9	*	NS	NS
2011	172.4	166.4	172.9	152.7	170.8	130.5	170.6	151.4	161.0	+	NS	NS
2012	33.7	13.2	25.0	26.1	38.6	39.7	23.9	34.8	29.4	NS	NS	NS
2013	204.2	195.6	204.9	190.1	199.0	212.9	201.6	200.6	201.1	NS	NS	NS
2014	149.2	173.8	191.5	155.4	158.7	186.1	171.5	166.7	169.1	NS	*	NS
2015	172.5	178.1	188.6	167.2	168.6	187.0	179.7	174.2	177.0	NS	+	NS
2016	186.2	198.7	190.8	191.3	184.5	173.4	191.9	183.1	187.5	NS	NS	NS

Note: +, *, and ** denote statistical significance at the 0.10, 0.05, and 0.01 levels, respectively; ‘NS’ means it was not statistically significant.

Table 4. Average annual soybean yields observed in a long-term trial conducted at the Southeast Research Farm in Beresford, South Dakota comparing tilled and no-till plots under three different rotations. Data are from 1991 through 2016. 'CT' refers to conventional tillage, and 'NT' refers to no-till. Note that while corn and soybeans were always part of each rotation, the other crops in the three year and flex rotations were not consistent over the years and the flex rotation sometimes included two soybean crops in a four year period.

YEAR	CT 2-Year	CT 3-Year	CT Flex	NT 2-Year	NT 3-Year	NT Flex	CT Average	NT Average	ALL Average	Tillage	Rotation	Tillage by Rotation
	(bu/ac)	(bu/ac)	(bu/ac)	(bu/ac)	(bu/ac)	(bu/ac)	(bu/ac)	(bu/ac)	(bu/ac)			interaction
1991	34.6	34.4	-----	36.8	34.3	-----	34.5	35.5	35.0	NS	NS	NS
1992	46.4	43.0	-----	46.8	43.4	-----	44.7	45.1	44.9	NS	*	NS
1994	51.9	45.7	-----	57.7	52.5	-----	48.8	55.1	52.0	+	*	NS
1995	41.7	35.4	-----	42.5	40.0	-----	38.5	41.2	39.9	NS	*	NS
1996	52.5	51.5	54.3	52.5	47.3	52.6	52.8	50.8	51.8	+	*	NS
1997	40.3	36.7	35.3	39.9	36.6	45.5	37.4	40.6	39.0	*	NS	*
1998	46.0	45.5	48.1	42.4	43.6	45.7	46.6	43.9	45.2	**	NS	NS
1999	23.3	29.9	31.3	29.6	29.0	34.6	28.2	31.1	29.6	NS	NS	NS
2000	42.3	40.9	35.6	48.5	50.4	50.2	39.6	49.7	44.6	**	NS	*
2001	43.7	40.7	43.1	43.8	44.3	47.3	42.5	45.1	43.8	**	NS	NS
2002	39.6	35.2	36.2	48.5	38.7	36.5	37.0	41.2	39.1	*	NS	NS
2003	43.2	42.7	39.4	41.1	46.2	49.4	41.8	45.6	43.7	*	*	**
2004	56.0	55.3	55.4	57.6	54.5	63.0	55.6	58.4	57.0	*	NS	*
2006	48.3	48.0	51.8	44.2	47.7	53.1	49.4	48.3	48.8	NS	NS	NS
2007	49.9	47.9	50.0	46.7	51.3	46.1	49.3	48.0	48.6	NS	NS	+
2008	38.4	42.9	50.6	42.8	44.5	46.2	44.0	44.5	44.2	NS	NS	NS
2009	59.0	58.0	64.1	62.4	61.4	63.0	60.4	62.3	61.3	NS	*	NS
2010	61.4	57.8	59.5	60.9	64.3	60.5	59.6	61.9	60.7	NS	NS	NS
2011	42.4	39.8	36.6	37.8	36.0	36.5	39.6	36.8	38.2	NS	NS	NS
2012	9.9	8.4	9.0	13.4	11.5	18.2	9.1	14.4	11.7	**	**	NS
2013	58.4	57.1	55.3	57.8	59.1	56.8	56.9	57.9	57.4	NS	NS	NS
2014	57.5	61.9	62.4	55.9	52.0	60.8	60.6	56.2	58.4	*	+	+
2015	59.2	65.3	67.9	66.8	64.0	66.6	64.1	65.8	65.0	NS	NS	**
2016	52.1	57.7	59.0	55.2	57.6	64.1	56.3	59.0	57.6	NS	NS	NS

Note: +, *, and ** denote statistical significance at the 0.10, 0.05, and 0.01 levels, respectively; 'NS' means it was not statistically significant.

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Evaluation of In-Furrow Application of Fertilizer on No-Till Corn

Peter Sexton*, Anthony Bly,
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INTRODUCTION

This trial was conducted to look at the effect of adding 'Generate' to an in-furrow application of 10-34-0, and also look at addition of a supplemental application of UAN in a surface band at planting, versus 10-34-0 with water, and also in relation to an untreated control (no in-furrow application). This trial was conducted at the SDSU Southeast Research Farm in Beresford, South Dakota.

METHODS

Corn hybrid P0589AM was no-till seeded on 8 June, 2017, at a seed rate of 28,000 seeds per acre at a depth of 2.6". The previous crop was soybeans. Fertilizer was applied at a rate of 144 lb/ac N and 20 lb/ac sulfur to the whole field on April 13, 2017. Initial soil P was 7 ppm (Olsen P). Plot size was 6 rows by 100 feet in length. Plots were laid out in a randomized complete block design with four replications.

Four treatments were imposed:

1. Control
2. In-furrow (6 gal/ac 10-34-0
3. With water in a 3:1 mix)
4. In-furrow + surface band
   (UAN at 9 gal/ac)
5. In-furrow + Generate (1 pt/ac)

Measurements of leaf number, SPAD readings, and plant height (3 plants per plot for each variable) were taken on July 21. Yield samples were taken from the inner four rows of the plot for the length of the plot using a Kincaid Plot Combine (Model 2065). Stand counts were taken from two points, six feet of row each, after harvest in each plot. Data were analyzed as a RCBD design with the SAS GLM procedure considering all variables as fixed effects.

RESULTS AND DISCUSSION

All the in-furrow treatments increased grain yield relative to the control, but did not differ from each other in yield (Table 1). The treatments with the addition of 'Generate' and with the addition of supplemental N as UAN in a surface band were not significantly different in yield from the treatment that only received 10-34-0 with water. There were no differences observed in grain moisture, test weight, stand, or seed size at harvest. Earlier in the season there were visible height differences between the treatments with the control plot showing shorter plant height than the other treatments, and the

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in-furrow only treatment being slightly taller than the plots that also received 'Generate'.

The observed trend for a yield advantage with use of 10-34-0 in-furrow is consistent with previous work done at the Southeast Farm. This is the fifth season at the Southeast Farm that we have had a trial that included an in-furrow fertilizer treatment utilizing 10-34-0. In each of the trials the treatment with 10-34-0 tended to yield more than the control, generally ranging from 5 to 10 bu/ac higher yield with in-furrow application of fertilizer.

Table 1. Plant height, leaf number, and SPAD reading from the youngest mature leaf (as measured on July 21, 2017), along with grain moisture, test weight, stand, 100-seed weight, and grain yield at harvest for corn grown with for different in-furrow fertilizer treatments applied at planting in a trial conducted at the SDSU Southeast Research Farm in Beresford, SD in 2017. Treatments were an in-furrow application plus surface banded fertilizer (9 gal/ac of UAN 2" to the side of the furrow), in-furrow application plus 'Generate' at 1 pt/ac, in-furrow only, and a control. The in-furrow treatment by itself consisted of 6 gal/ac 10-34-0 with water mixed in a 3:1 ratio.

Treatment	**Height**	**Leaf Number**	**SPAD**	**Moisture**	**Test Wt.**	**Stand**	**100-Seed Wt.**	**Yield**
	(cm)			(%)	(lb/bu)	(plants/ac)	(g)	(bu/ac)
In-Furrow+Surface Band	143.7	10.4	57.3	21.9	52.4	27225	31.5	153.3
In-Furrow+Generate	140.1	10.6	56.8	21.4	52.8	27588	30.7	150.2
In-Furrow only	144.6	10.9	57.3	21.7	52.7	28677	30.7	148.2
Control	136.1	10.5	54.7	22.0	52.2	26136	28.9	139.4
Mean	*141.1*	*10.6*	*56.5*	*21.8*	*52.5*	*27407*	*30.4*	*147.8*
CV (%)	*2.1*	*3.9*	*4.3*	*1.6*	*1.1*	*7.3*	*5.2*	*3.8*
LSD (0.10)	*3.8*	*NS*	*NS*	*NS*	*NS*	*NS*	*NS*	*7.2*

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Late Planted Corn for Grain or Grazing 2017

Brad Rops*, Scott Bird,
and Peter Sexton

INTRODUCTION

Precipitation in May of 2017 at the Southeast Research Farm was 5.57 inches, 2.05 inches above average. This led to delayed planting, especially in low-lying areas. One field was planted to a short season corn hybrid with the intention of grazing corn. A portion of the field was retained for a grain yield check. The performance data collected is not replicated, and is only observational for the 2017 growing season.

METHODS

On May 10, 2017, 340 pounds urea, 42 pounds ammonium sulfate, and 10 pounds elemental sulfur was applied per acre. Six acres of low-lying ground was planted to corn on June 15, 2017. Glyphosate was applied at 32 ounces per acre as a burn down. Federal 4440 CONV, a 94 day relative maturity hybrid, was planted at 26,000 seeds per acre. Post emergent weed control was 12 ounces of atrazine and 3 ounces of Callisto per acre applied with 1% crop oil and 2.5% urea ammonium nitrate at 15 gallons per acre spray volume on July 7, 2017, Final stand was 24,000 plants per acre.

20 fall-born heifers weighing 765 pounds were utilized for grazing the corn. Grazing began on August 21, after the 45 day grazing restriction on Callisto had passed. Corn was in the blister stage at this point. An energized fence of braided poly-wire and step-in pigtail posts was used to allow access to about 3 days' worth of grazing at a time. A path in the corn was run down prior to putting in the next line of fence. A portion of the corn was left standing to allow a grain yield check in the fall.

RESULTS AND DISCUSSION

Grazing began in the blister stage and continued through early milk. The available biomass when grazing began on August 21 was 7,938 pounds of dry matter per acre. The heifers grazed 5.5 acres over a period of 23 days for an equivalent of 83 head days per acre. The heifers averaged 765 pounds when grazing began. They were weighed again on October 4 and averaged 888 pounds. Average daily gain for this period was 2.93 pounds per day. Corn grazing ceased on September 13 when the heifers were moved to Sorghum-Sudan regrowth. It is plausible to assume that the average daily gain for the 23 days on corn was at least equal to, if not greater than, the 2.93 pounds per day for the entire 44 day period between the two weights. Gains of over 3 pounds per day on corn have been observed in other years.

Using an average daily gain of 2.93 pounds for 20 head over 23 days on 5.5 acres results in 245 pounds of gain per acre. The October 2, 2017 market at Sioux Falls Regional Livestock for similar weight heifers was $137 per cwt. This

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would produce $335.65 of gross return per acre for grazing the corn.

The remaining corn was harvested October 31, 2017. The moisture content on that day was 24.5% and the adjusted grain yield was 72.64 bushels per acre at 15% moisture. Cash price for corn in Beresford, SD on October 31, 2017 was $3.13 per bushel. Gross return per acre for grain for this particular field and hybrid would have been $227.36.

CONCLUSION

Delayed corn planting forces decisions to be made: 1) plant the corn and take a yield reduction, 2) switch to a different crop, 3) abandon the acres and plant a cover crop. While crop insurance needs to be considered, grazing is an option if you choose to stay with corn. In this 2017 demonstration, grazing generated almost $100 more gross return per acre than corn for grain. Regardless of the option chosen, it is beneficial to have plants growing on those acres to utilize excess water, capture nutrients, and protect the soil.

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Grazing Cover Crops and Annual Forages in 2017

Brad Rops*, Scott Bird,
and Peter Sexton

INTRODUCTION

Integrating livestock into crop production by grazing cover crops or annual forages has several benefits. From the livestock side it can extend the grazing season, supplement or rest existing pastures, or provide an economical way put weight on stocker cattle. From the agronomic perspective, livestock grazing can add value to acres planted to cover crops or annual forages as part of a cropping system or due to crop failures. Grazing also breaks down residue leaving a protective layer of mulch and helps to recycle nutrients quicker for the subsequent crop. Grazing work done at the Southeast Farm looked at the forage production and cattle performance for several different crops and mixes throughout the 2017 growing season. The performance data collected is not replicated, and is only observational. Data is being gathered regarding soil characteristics and the performance of the following grain crops which will be reported in the future.

METHODS

Twenty fall-born heifers were utilized for grazing cover crops and annual forages. Grazing progressed through a series of fields according to crop maturity and available biomass. In some fields the cattle were given full access, in other fields strip grazing was utilized with a stocking rate of approximately 50,000 pounds per acre.

The crops utilized were cereal rye, a cool season cover crop mix, a warm season cover crop mix, and late planted field corn. For two interim periods the heifers grazed an alfalfa/grass mix either waiting for other forage to put on adequate growth, or, in the case of the corn, for the grazing interval to pass due to the herbicide that was applied.

The heifers were weighed periodically, although not at regular intervals or strictly according to field changes. In addition to grazing, the heifers were offered free-choice mineral. Water was hauled as needed, and always available. Cross fencing was done with braided poly wire and step-in posts.

RESULTS AND DISCUSSION

The heifers were first placed on cereal rye as an acclimation period. The heifers came out of a dry lot and had been fed a silage ration. The rye on June 2 was heading and was declining rapidly in feed value. We maintained the heifers on rye to give the cool season cover crops (CSCC) time to put on growth. There was some shrink in the first 18 days of grazing, but due to different scales and transportation of the heifers, it is difficult to gage the actual loss attributed to the rye. It serves as a reminder to get cattle on rye early, while its forage value is high.

A CSCC mix was planted April 12, 2017 consisting of oats, Italian rye grass, crimson clover, alsike clover, red clover, and ‘Winifred’ brassica. Grazing began on June 20 with available forage of 2800 to 3500 pounds dry

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matter per acre. Temporary fence was used to allow one day's worth of grazing at a time. They had the opportunity to go back over previously grazed cover crops. Most of the forage was 'Horsepower' oats and 'Winifred' brassica. After the first grazing, the Italian ryegrass and clovers provided growth for a second grazing in the fall.

A warm season cover crop (WSCC) mix of sorghum x sudan, pearl millet, German millet, Japanese millet, and cow pea was planted June 16, 2017 in field 201C following a grazed rye cover crop. Grazing started July 29, 2017 with available dry matter per acre of 3660 pounds. Fencing was moved to allow cattle fresh forage every 1-2 days. Utilization of the forage was 65% with the rest left for residue and regrowth. After a 29 day rest period, the field was grazed again beginning September 13 until frost when the heifers were moved to CSCC.

Corn planting was delayed on some acres due to higher than normal precipitation in May. On June 15, 2017, 5.5 acres were planted to a 94 RM conventional hybrid with the intention of grazing. Grazing began August 21, after the herbicide grazing restrictions had cleared. Available forage was 7940 pounds of dry matter per acre of which 72% was consumed. The corn was in the blister stage when grazing began and in early milk when the last of the acreage was grazed.

During periods when there was not available cover crops to graze, the heifers were turned onto a vegetative treatment area (VTA) of alfalfa and grass. The first hay cutting was harvested (2950 pounds per acre) and the heifers grazed the second and third cuttings. Four to six inches of growth was always left and the nutrients grazed were returned to the soil. Table 1 shows the fields and crops grazed, the acres, and the number of days grazed.

The heifers grazed 35.5 acres a total of 166 days. Average body weight on June 20 was 634 pounds and the end weight was 952 pounds on November 15 for an average daily gain (ADG) of 2.15 pounds. Periodic weight checks showed ADG ranged from 1.52 to 2.93 pounds per day. Table 2 shows the economic return from grazing based on daily maintenance costs or value of gain.

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Table 1. Fields, acres and amount of time spent grazing fields during the 2017 grazing season at the Southeast Research Farm, Beresford, SD.

Field	Crop	Acres	Number of Times Grazed	Number of Head	Total Days Grazed	Head Days / Acre
201B	Corn	5.5	1	20	23	83
201C	Rye/WSCC[1]	6.5	3	20	42	129
203N	Rye	2.3	1	20	4	35
203S	CSCC[2]	3.2	2	20	23	144
204S	CSCC	5.0	2	20	26	104
VTA	Alfalfa/grass	13.0	2	20	48	74
Total		35.5			166	94

[1]WSCC = Warm Season Cover Crop Mix [2]CSCC = Cool Season Cover Crop Mix

Table 2. Economic Return from grazing based on daily maintenance costs or value of gain during 2017 grazing period at Southeast Research Farm, Beresford. SD.

	Maintenance	**Growth**
Total Production	3320 grazing days	7138 pounds
Value of Production	$1.50 per day	$1.35 per pound
Total Revenue	$4,980.00	$9,636.30
Revenue Per Acre	$140.28	$271.45

Fig 1. Heifers grazing in one of the fields used during the 2017 growing season; Southeast Research Farm, Beresford, SD.

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Tile Drainage Study at the Southeast Farm – 2017 Soybean Yields and Pooled Analysis Across Years

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INTRODUCTION

This paper reports on soybean yield from tile drainage studies at the Southeast Farm in 2017. A series of twelve tile drainage plots were established at the Southeast Farm in 2013 with the objective of monitoring N and water movement in tile relative to environmental conditions, and to look at corresponding impacts of drainage on grain yield. These plots were established on marginally drained land which had a history of grain crop production and capable of producing a crop most years, but was often negatively impacted by excess moisture. Two levels of treatments were imposed on these plots: drained vs. undrained; and in the corn part of the rotation use of untreated urea vs. use of urea treated with N stabilizers (NPBT and dicyandiamide).

Another pair of plots were added to the tile drainage study in 2014 on a separate field that had been seeded to reed canarygrass (*Phalaris arundinacea*) and used for producing grass hay because it frequently flooded and was unsuitable for grain crop production due to its poor drainage. These plots were tiled and seeded to soybeans in 2014, oats in 2015, corn in 2016, and soybeans again in 2017. This second study had treatments of tile lines being open all year versus tile drainage lines only being open during the growing season (continuous vs. seasonal drainage, respectively).

METHODS

The study looking at impact of tile drainage, and use of an N stabilizer on corn yield and N movement during corn production, has been managed without tillage since 2014 (4^{th} season of no-till management). The plots were seeded to P25T51 soybean on 06 June, 2017. There were two treatments in the soybean phase of the project: undrained, and tile drained. The plots are about 0.75 acres in size and are laid out in a RCBD with three replications. Yield samples were taken at harvest from eight rows running a distance of 180 feet from each of the split plots and then combined for whole plot analysis. Data from these plots were subjected to standard ANOVA for a RCBD design using Proc GLM in SAS statistical software. The split plot component looking at N stabilizers in corn was not considered in the soybean analysis because in the soybean part of the rotation the plots are managed the same (no split plot treatment), and preliminary analysis of the data shows no significant effect ($P > 0.40$) on soybean yield

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from use of a N stabilizer in the previous year (2016).

In a separate field split into two large plots, an unreplicated observation study was carried out looking at impacts of limiting drainage to the duration of the growing season (seasonal drainage) versus leaving the tile line open all year (continuous drainage). This field is in its third season of no-till management. The field was planted to AG2936 soybean on 02 June, 2017. Yield samples were collected from an area 12 rows wide by 470 feet long in each of the two plots.

RESULTS

In the previous season (2016) with corn, the tiled drained plots had shown a 19 bu/ac yield advantage over the undrained plots. In 2017 there was excess moisture with heavy rainfall in the spring; however, the rains stopped in June and by late July and early August there was some mild drought stress in the field. Rains in August relieved this stress, and in the end there was no significant effect of tile drainage on soybean yield in 2017 (Table 1). There was, however, a trend for soybeans in the tile drained plots to yield about 5 bu/ac more than those in the undrained plots, and to have slightly greater plant stand at maturity (Table 1). Grain moisture, test weight, and seed weight were similar across drainage treatments in 2017. It should be kept in mind that there are a limited number of field replicates in this trial, so that limits the power of the statistical analysis in any given season.

This project has been running since 2013, so this is the third time soybeans have been raised in these plots since the trial started. When yield data is combined across seasons (2013, 2015, and 2017) it shows significantly greater soybean yields in plots with tile drainage – on average 4.4 bu/ac more was produced on drained plots than on undrained plots (Table 2).

A separate observation study was also conducted to look at seasonal versus continuous drainage at the Southeast Research Farm in 2017. This particular field is split in two, with half of the field under continuous drainage, and the other half under seasonal drainage (the tile line is closed when the crop is not in the field). Soybean yields were virtually the same in the two observation plots; 65.3 bu/ac with continuous drainage and 65.2 bu/ac with seasonal drainage. This is an unreplicated observation study, so results need to be interpreted with caution. However, this suggests that there is potential for using seasonal drainage (aka 'Drainage Water Management') to limit movement of water and with it nitrate, out of the field in the off season and still maintain good yield potential for soybeans.

ACKNOWLEDGEMENT

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Table 1. Moisture, seed weight, test weight, yield and stand for soybeans grown in paired research plots with and without tile drainage at the Southeast Research Farm in Beresford, South Dakota, in 2017.

2017 SEASON **Tile Drainage**	**Moisture**	**100-Seed Wt.**	**Test Wt.**	**Yield**	**Stand**
	(%)	(g)	(lb/bu)	(bu/ac)	(plants/ac)
tile	12.8	20.5	56.4	58.8	106238
none	13.4	20.7	56.2	54.1	95590
Mean	*13.1*	*20.6*	*56.3*	*56.4*	*100914*
CV (%)	*2.8*	*2.2*	*0.5*	*8.6*	*8.9*
P-value	*NS*	*NS*	*NS*	*NS*	*NS*

Table 2. Data pooled across seasons (2013, 2015, and 2017) for moisture, test weight, and yield for soybeans grown in paired research plots with and without tile drainage at the Southeast Research Farm in Beresford, South Dakota. The data on plant stand at harvest is from the 2015 and 2017 seasons only.

AVERAGE ACROSS SEASONS **Tile Drainage**	**Moisture**	**Test Wt.**	**Yield**	**Stand**
	(%)	(lb/bu)	(bu/ac)	(plants/ac)
tile drained	14.0	57.5	56.5	116520
none	14.2	57.0	52.1	113140
Mean	*14.1*	*57.2*	*54.3*	*114830*
CV (%)	*4.4*	*0.8*	*6.3*	*6.0*
P-values: Tile	*NS*	*	*	*NS*
*Year*Tile*	*	*NS*	*NS*	*NS*

Table 3. Soybean stand, test weight, seed weight, and yield from side by side observation plots with continuous and controlled management drainage at the Southeast Research Farm in Beresford, South Dakota in 2017.

Type of Drainage	**Stand**	**Test Wt.**	**100-Seed Wt.**	**Yield**
	(plants/ac)	(lb/bu)	(g)	(bu/ac)
Continuous Drainage	103580	53.2	18.6	65.3
Seasonal Drainage	93900	55.7	18.7	65.2

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2017 Progress Report
Agricultural Experiment Station
Plant Science Department
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Drainage Management Research: Measurement of Water Flow and Quality at the Southeast Farm

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INTRODUCTION

Subsurface drainage has increased dramatically in eastern South Dakota in the last several years driven by increases in precipitation and commodity and land prices. This research will evaluate the economic, water quality, and hydrologic impacts of drainage in South Dakota.

We have separated the research into four components-a core component and three associated components. The core component is a monitoring network to study strategies to best manage water and nutrients on tiled and non-tiled fields at plot and field scales. This basic instrumentation setup will feed into the other three research components addressing drainage design criteria and economics, water quality and nutrient management, and hydrologic impacts of drainage (Fig. 1). This report provides a brief discussion of drainage research conducted at the SDSU Southeast Research Farm.

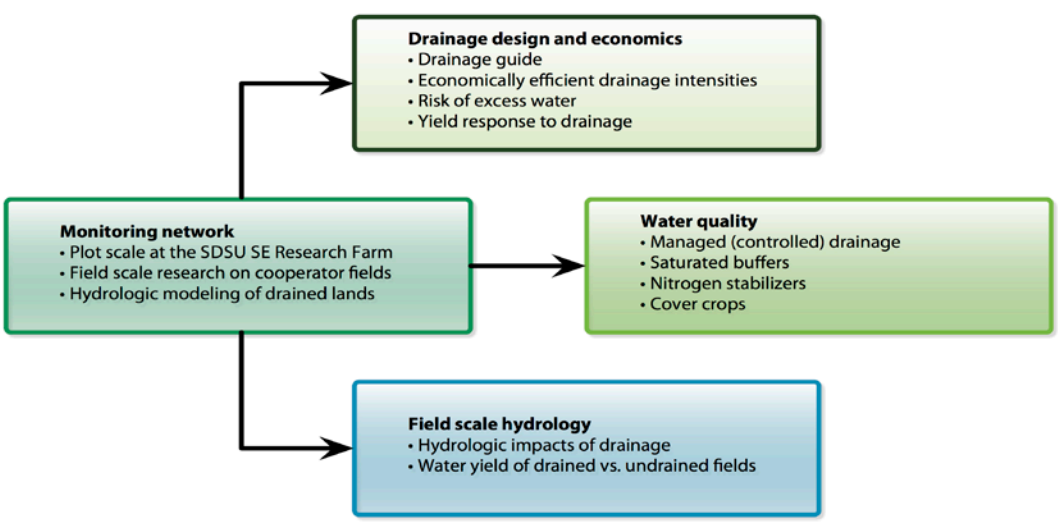

Fig. 1. Diagram of research project components

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OBJECTIVES

The proposed research seeks to:

1. Develop guidance on drainage intensity and drain spacing for representative soils and climatic conditions in South Dakota to maximize economic benefits and minimize negative environmental impacts
2. Evaluate the impact of nitrogen stabilizers on nitrate losses from drained areas
3. Compare the water yield among conventionally drained, managed drained, and undrained fields
4. Demonstrate and evaluate the use of managed (controlled) drainage and saturated buffers for reducing nitrate losses from tile drained fields
5. Evaluate potential cover crop strategies to manage wet areas and to tie up nutrients and reduce drainage outflow.

METHODS

Study Plots

Two sets of subdrainage plots were installed at the SDSU Southeast Research Farm. The first set of plots (North plots) were installed during the week of May 6–10, 2013. The drain lines were installed in six plots of approximately 1-acre size across two fields that have been in a long-term corn-soybean rotation (Fig. 2). The drain lines were installed at a 4-ft. depth with 80-ft. spacings. For the soils in the plots, this results in an estimated drainage coefficient (design capacity of the drainage system) of ½ inch per day at 4-ft deep or ⅜ inches per day when operated at a 3-ft. outlet depth. Three of the plots are operated as drained to a 3-ft. depth, and the other three plots have the outlets closed and are operated as undrained.

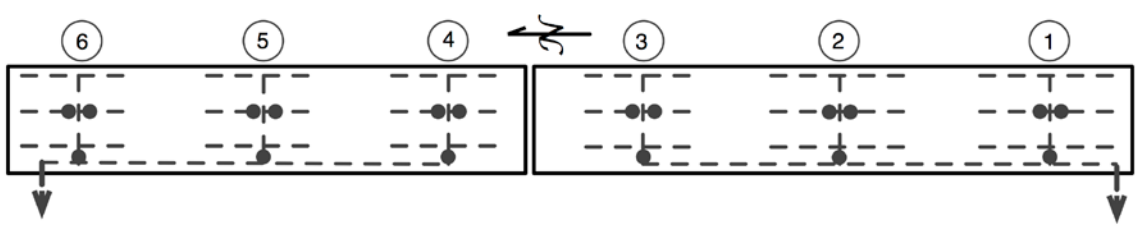

Fig. 2. North subsurface drainage plots at the Southeast Research Farm. Dashed lines are the tile lines, and dots are the control structures. Plots 2, 3, and 6 are drained to a 3-ft. depth, and plots 1, 4, and 5 have the outlets closed and are managed as undrained. Within each of these plots, half of the plot receives conventional urea nitrogen applications and the other half will receive applications of nitrogen with a nitrogen stabilizer (nitropyrin) during corn years.

The study is set up in a split-plot design with drainage as the whole-plot treatment and nitrogen as the split-plot treatment. The tiled plot area was seeded to soybeans in the spring of 2013 after disking operations to smooth out the fields following the drainage installation. The drained plots were planted on June 3rd, 2013. Because of wet conditions, planting was delayed on the undrained plots until June 18th and 20th. With the beginning of a new study, however, there was some initial confusion over study goals that resulted in one of the drained plots being planted later than it could have been. Corn was planted in 2014 followed by soybeans in 2015 and corn in 2016 on these plots.

Soil moisture, water level, and precipitation monitoring instrumentation were installed in the summer of 2013. Stevens Hydra Probe II sensors for continuous measurement of soil water content, soil temperature, and electrical conductivity were installed on the control (conventional nitrogen) side of each whole-plot at depths of 6″, 18″, 30″, and 42″. Decagon CTD sensors were installed in each of the control structures for continuous measurement of water level (for calculating drain discharge), water temperature, and electrical conductivity. Monitoring wells were installed in each whole-plot, midway between two tile lines, for monitoring shallow groundwater levels. Additionally, two tipping bucket gages were installed for measuring precipitation. Other climatological measurements will come from the existing weather station at the research farm. Table 1 summarizes the datasets being collected from the six research plots to date.

The second set of subdrainage plots (9.3-acre) were installed during the week of September 23, 2013 and named the South plots. The plots consist of a 4-acre plot for conventional drainage and a 5.3-acre plot for drainage water management (DWM) (Fig. 3). The tiles were installed at 4-ft deep with 40-ft spacing. Oats were planted on these plots in 2015 and corn was planted in 2016 to match the North plots (Fig. 2). The data collected on North plots are also being collected for these plots, except crop yield data will be collected from 2016 harvest. The conventional drainage plot operated with an estimated drainage coefficient (design capacity of the drainage system) of ⅜ inches per day. The outlet of the DWM plot is controlled with a riser board which is removed, raised or lowered, as needed, according to growing and non-growing seasons. Specifically;

1. The boards are removed in early April for corn and mid-April for soybeans. The boards should be removed approximately 3 weeks prior to planting, depending on existing and forecast conditions.
2. After planting:
    - Corn: Boards are replaced to 18 inches below the soil surface at the control structure. When corn reaches the 4-leaf stage, the outlet elevation should be lowered to 24 inches below the soil surface. When corn reaches the 10-leaf stage, the outlet elevation are lowered to 30 inches below the surface and left there for the remainder of the growing season.
    - Soybean: Boards are replaced to 24 inches below the soil surface at the control structure until the beans reach 8 inches tall and then

the boards are lowered to 30 inches below the surface and left there for the remainder of the growing season.

3. If needed, boards are removed 10 days before harvest.
4. Boards are replaced within one week after harvest to 6 inches below the soil surface.

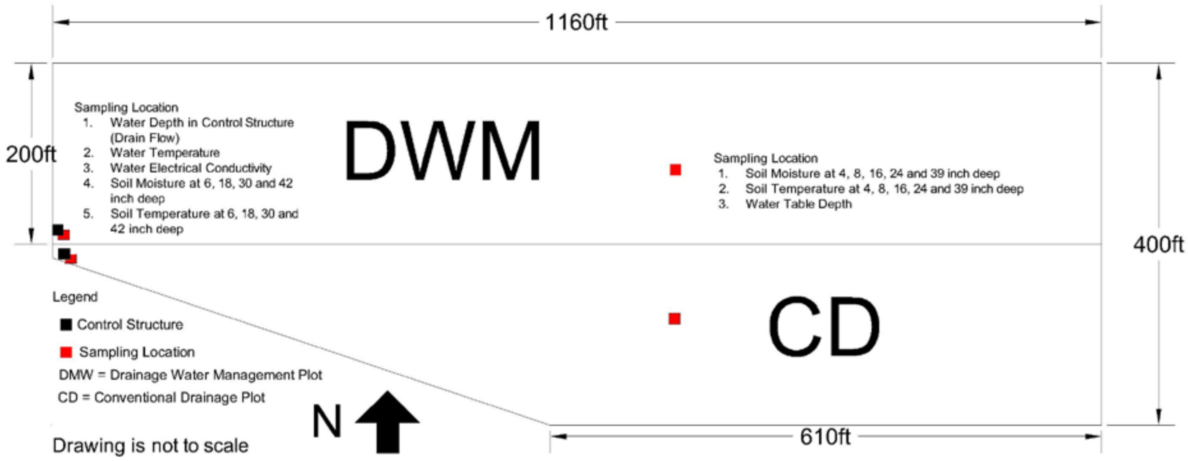

Fig. 3. Layout of Drainage Water Management Plots (i.e. South Plots) at SDSU SERF near Beresford, SD.

Statistical Analysis

The data have not yet been statistically analyzed to determine the effects of drainage on soil water characteristics and crop yields. The information presented in this report is strictly a summary of field data collected.

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Table 1. List of data being collected from research plots at SDSU Southeast Research Farm near Beresford, South Dakota.

No.	Data Type	Frequency	Equipment	Description	Start Date	End Date	Unit of Measmt	Remark
1	Drain Flow	15 min	Decagon CTD	Water Depth in Control Structure	9/11/2013	Present	mm	Removed during winter
2	Temperature	15 min	Decagon CTD	Water Temperature	9/11/2013	Present	°C	Removed during winter
3	Electrical Conductivity	15 min	Decagon CTD	Water Electrical Conductivity	9/11/2013	Present	dS/m	Removed during winter
4	Soil Moisture	15 min	Stevens Hydra Probe II	Soil Moisture Depth - 6 inch	9/11/2013	Present	m^3/m^3	Continuous
5	Soil Moisture	15 min	Stevens Hydra Probe II	Soil Moisture Depth - 18 inch	9/11/2013	Present	m^3/m^3	Continuous
6	Soil Moisture	15 min	Stevens Hydra Probe II	Soil Moisture Depth - 30 inch	9/11/2013	Present	m^3/m^3	Continuous
7	Soil Moisture	15 min	Stevens Hydra Probe II	Soil Moisture Depth - 42 inch	9/11/2013	Present	m^3/m^3	Continuous
8	Soil Moisture	15 min	Decagon 5TM	Soil Moisture Depth - 54 inch	4/30/2015	Present	Ea	Continuous
9	Soil Temperature	15 min	Stevens Hydra Probe II	Soil Temperature Depth - 6 inch	9/11/2013	Present	°C	Continuous
10	Soil Temperature	15 min	Stevens Hydra Probe II	Soil Temperature Depth - 18 inch	9/11/2013	Present	°C	Continuous
11	Soil Temperature	15 min	Stevens Hydra Probe II	Soil Temperature Depth - 30 inch	9/11/2013	Present	°C	Continuous
12	Soil Temperature	15 min	Stevens Hydra Probe II	Soil Temperature Depth - 42 inch	9/11/2013	Present	°C	Continuous
13	Soil Temperature	15 min	Decagon 5TM	Soil Temperature Depth - 54 inch	4/30/2015	Present	°C	Continuous
14	Soil Electrical Conductivity	15 min	Stevens Hydra Probe II	Soil Electrical Conductivity Depth - 6 inch	9/11/2013	Present	S/m	Continuous
15	Soil Electrical Conductivity	15 min	Stevens Hydra Probe II	Soil Electrical Conductivity Depth - 18 inch	9/11/2013	Present	S/m	Continuous
16	Soil Electrical Conductivity	15 min	Stevens Hydra Probe II	Soil Electrical Conductivity Depth - 30 inch	9/11/2013	Present	S/m	Continuous
17	Soil Electrical Conductivity	15 min	Stevens Hydra Probe II	Soil Electrical Conductivity Depth - 42 inch	9/11/2013	Present	S/m	Continuous
18	Soil Moisture	15 min	UMS T4 Tensiometer	Tensiometer, Depth - 54 inch	4/30/2015	Present	KPa	Wet End
19	Soil Moisture	15 min	UMS T4 Tensiometer	Tensiometer, Depth - 78 inch	4/30/2015	Present	KPa	Wet End
20	Soil Moisture	15 min	Camp Sci 229	Soil Matric Potential, Depth - 54 inch	4/30/2015	Present	Degree Celcius	Dry End

21	Soil Moisture	15 min	Camp Sci 229	Soil Matric Potential, Depth - 78 inch	4/30/2015	Present	Degree Celcius	Dry End
22	Water Table Depth	15 min	Hobo Water Level Logger	Water Depth - Observation Well	8/21/2014	Present	m wrt sensor depth	Removed during winter
23	Water Table Depth	15 min	Hobo Water Level Logger	Water Depth - Deep Well	8/21/2014	Present	m wrt sensor depth	Removed during winter
24	Soil Penetration Resistance	Weekly	Cone Penetrometer	Cone Penetration	4/9/2014	7/11/2014	KPa	Growing Season
					3/31/2015	10/6/2015	KPa	Growing Season
25	Leaf Area Index	Weekly	Ceptometer	Leaf Area Index	7/9/2014	10/2/2014	unitless	Growing Season
					6/23/2015	9/1/2015	unitless	Growing Season
26	Nutrient Analysis	Random	Grab Sampling Method	Nitrate-Nitrate Analysis	6/10/2014	7/22/2014	mg/L	When there is flow
					5/13/2015	7/7/2015	mg/L	When there is flow
27	Precipitation	15 min	Tipping Buck Rain Gauge	Precipitation	9/11/2013	Present	mm	Continuous
28	Infiltration	Monthly	4 inch Infiltration Ring	Sorptivity	5/8/2014	8/21/2014	ml/min	Growing Season
					3/31/2015	7/14/2015	ml/min	
29	Bulk Density	Year 1, 3, 5 and 10	AMS bulk density kit	Bulk Density			gm/cm^3	Within 1 month of planting
30	Grain Yield	Yearly	Kincaid Plot Combine	Plot area 15' x approximately 185'	5/1/2013	Present	bu/acre	Annually
31	100 Seed Weight	Yearly	Hand Count / Gram Scale	Hand Count	5/1/2013	Present	grams	Annually
32	Stand Count	Yearly	Hand Count	Hand Count	5/1/2013	Present	plants	Annually
33	Soil Sampling & Analysis (Nitrate-N, Olsen P, K, pH, Zn, S and EC (1:1 saturated paste))	Yearly	Tractor Probe	Analysis by SDSU Soils Lab	5/1/2013	Present	ppm	Annually
34	Corn Biomass Nutrient Analysis	Year 2	ICP tissue analysis	6' Samples; Dried, Weighed; Subsample Analyzed	11/7/2014	11/7/2014	lbs./ac	After Harvest

RESULTS

Nitrate is the primary parameter that was reported in past reports. This report includes additional data from 2016 and before that was analyzed during 2017. This data and information is part of Ashik Sahani's MS thesis which was defended in Fall, 2017.

Dissolved Phosphorus Concentration and Load in Drain Water

Water quality analysis for dissolved phosphorous concentration was performed in 2016. Daily dissolved phosphorous concentration and mean load is presented in Figure 4. The dissolved phosphorous concentration in conventional drainage ranged from 0.027 to 0.095 mg/L with a mean of 0.048 mg/L during the study period. In the controlled drainage plot, the concentration ranged from 0.040 to 0.127 with a mean of 0.081 mg/L

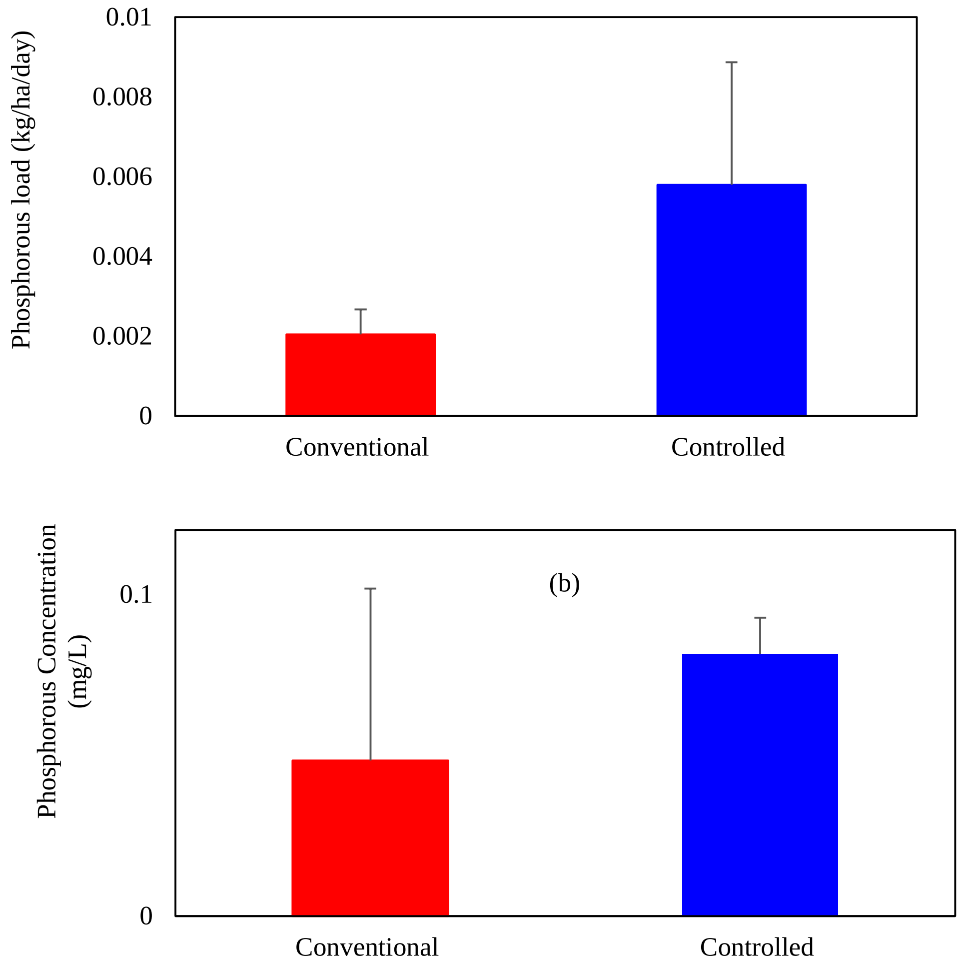

Figure 4. Mean dissolved phosphorous concentration (a) and daily mean load (b) at the outlet of drainage plots in South Dakota State University – Southeast Research Farm near Beresford, South Dakota.

While there was no seasonal pattern in dissolved phosphorus in 2016, the dissolved phosphorous concentration was consistently higher in controlled drainage than in conventional drainage. The mean dissolved concentration of drain water in the controlled drainage plot was slightly higher than the concentration in the conventional drainage plot; but was not statistically different ($p > 0.05$).

Daily mean dissolved phosphorus load from conventional and controlled drainage was 0.002 kg/ha/day and 0.005 kg/ha/day (Figure 4.6), and the total annual dissolved phosphorous load was 0.198 kg/ha and 0.309 kg/ha during 2016.

The drainage plots in this study have no boundary between them, meaning that there is a possibility of lateral flow and nutrient movement between the two plots.

Shallow Groundwater Table

Shallow groundwater table was measured in the middle of both the controlled and conventional drainage plots starting in the spring of 2016. The shallow groundwater table for the conventional drainage plot varied from 0 to 1.372 m with an overall mean of 1.168 m, while the water table for the controlled drainage plot varied from 0.081 to 1.372 m with an overall mean of 1.098 m. There was a statistically significant difference in mean shallow groundwater table depth between controlled and conventional drainage plots ($p < 0.05$). The water table in the controlled drainage plot was consistently higher than the water table in the conventional drainage plot during the measurement period.

The shallow ground water table depth shows a similar trend to outlet water depth and drain flow. Water table rise was generally observed during the spring (April and May) and fall (September and October) seasons when the precipitation was high during the study period (Figure 5). Water table depth in the conventional drainage plot dropped faster than the water table in the controlled drainage plot, suggesting that water is being held in the controlled drainage plot for a longer period of time. Water level was below the depth of the monitoring wells for both controlled and conventional drainage plots from mid-June to mid-September in 2016, which may be due to water loss via drainage, lateral or vertical seepage, and evapotranspiration. The shallow groundwater table fluctuation is driven by precipitation, soil type, and drainage design. At the study site, the shallow groundwater table is generally close to the ground surface during the spring season following precipitation and spring snow melt events; but draws down during summer before rising in the fall with precipitation events.

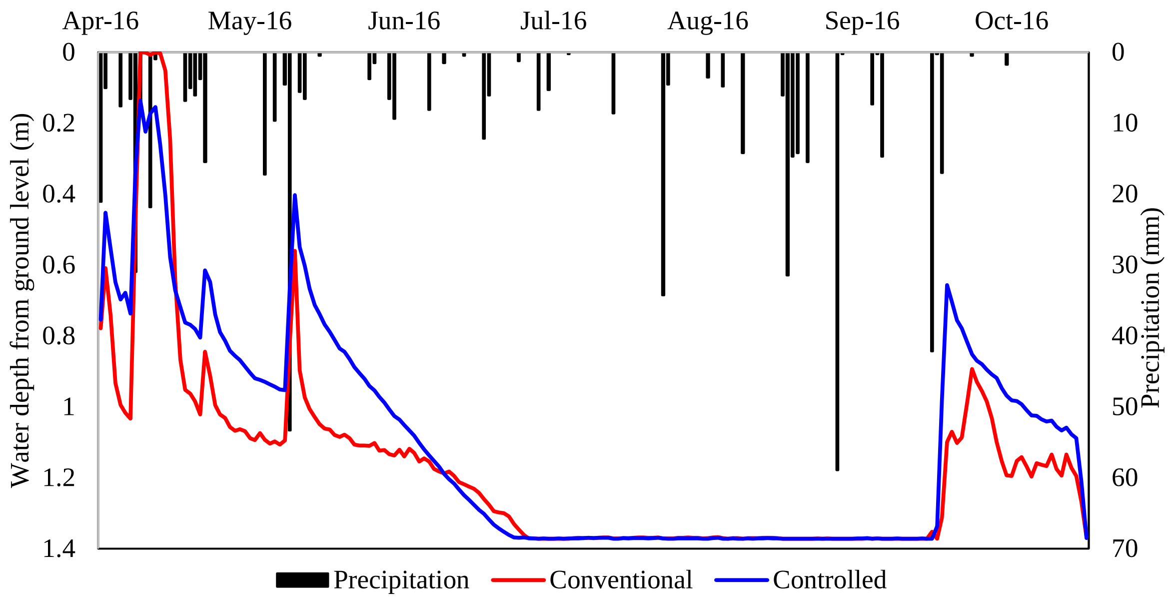

Figure 5. Daily shallow groundwater table and precipitation at the controlled and conventional drainage plots at South Dakota State University – Southeast Research Farm near Beresford, South Dakota.

Nitrate and Dissolved Phosphorous Concentrations in Shallow Groundwater

Water samples for nitrate and dissolved phosphorous concentrations from the monitoring wells were collected in the 2016 growing season. Nitrate concentration in the conventional drainage plot ranged from 2.9 to 31.3 mg/L with an overall mean of 19.4 mg/L. In the controlled drainage plot, the concentration ranged from 5.2 to 30.9 mg/L with an overall mean of 13.6 mg/L (Figure 6). There was no statistically significant difference in mean nitrate concentrations between the controlled and conventional drainage plots ($p > 0.05$).

The dissolved phosphorous concentration in the conventional drainage plot ranged from 0.088 to 0.441 mg/L with a mean of 0.257 mg/L, and from 0.032 to 0.202 mg/L with a mean of 0.091 mg/L for the controlled drainage plot (Figure 6). The mean dissolved phosphorous concentration in the controlled drainage plot was lower than that of the conventional drainage plot during the sampling period, and the difference was statistically significant ($p < 0.05$).

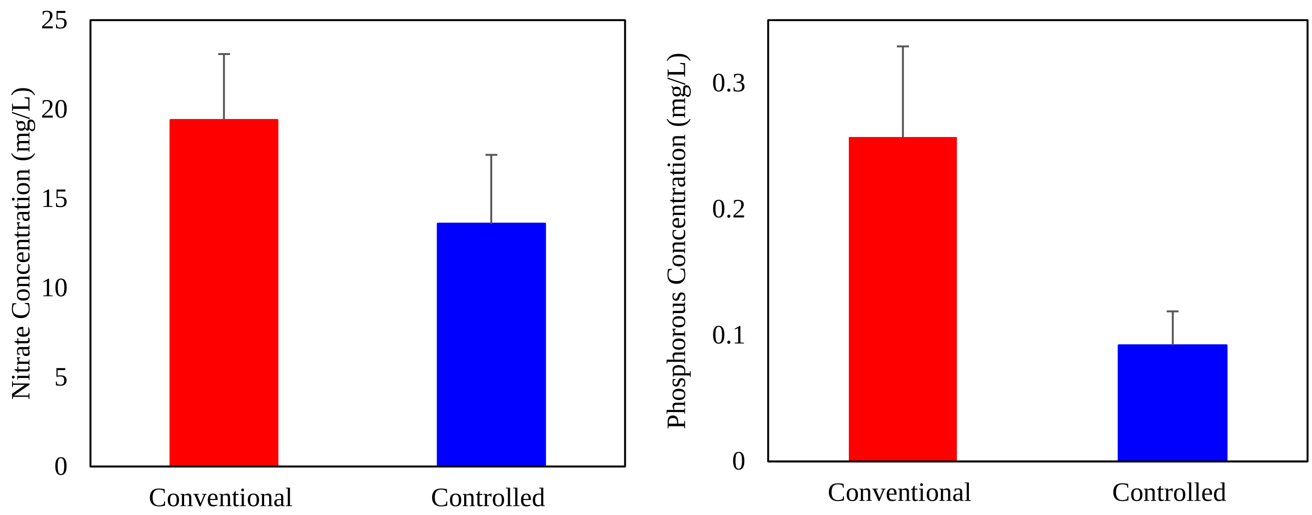

Figure 6. Nitrate (a) and dissolved phosphrous concentrations (b) in shallow groundwater in conventional and controlled drainage plots located at South Dakota State University – Southeast Research Farm near Beresford, South Dakota.

Both nitrate and dissolved phosphorous concentrations showed similar seasonal variations at the outlet and middle of plots, except the dissolved phosphorous concentration in the conventional drainage plot outlet, which was lower. Nitrate and dissolved phosphorus concentrations in both the controlled and conventional drainage plots depended on nitrate fertilizer application rates and precipitation events. Nutrient concentrations were generally high during spring (May to June) when spring fertilizer was applied under frequent spring rainfall events, while low concentrations were measured during fall when there was less precipitation.

Soil Mechanical Texture

Soil samples were collected in the fall of 2016 to assess soil texture at four different depths (0 - 10 cm, 10 – 20 cm, 20 – 30 cm, and 30 – 45 cm). The mean percentage of sand, silt, and clay for all four depths in the conventional and controlled drainage plots is presented in Figure 7. The overall mean percent sand, silt, and clay for the conventional drainage plot was 11.6%, 42.5%, and 45.9%, respectively and 14.9%, 45.8%, 39.3% for the controlled drainage plot. The soil in the conventional drainage plot was classified as silty clay at depths of 0 to 10 cm, 10 to 20 cm, and 20 – 30 cm, and as silty clay loam at 30 to 45 cm depth. In the controlled drainage plot, the soil was classified as silty clay at 0 to 10 cm depth, clay at 10 to 20 cm, and silty clay loam at 20 to 30 cm and 30 to 45 cm depths. Overall, the soil in the conventional drainage plot was classified as silty clay, and silty clay loam for the controlled drainage plot. The texture analysis conducted in this study revealed moderately fine textured and fine textured soils in the controlled and conventionally drained plots, respectively, which is similar to the soil texture group reported by USDA (2017) for these fields. These soils are somewhat poorly drained to very poorly drained, which supports the need for subsurface drainage to increase crop growth.

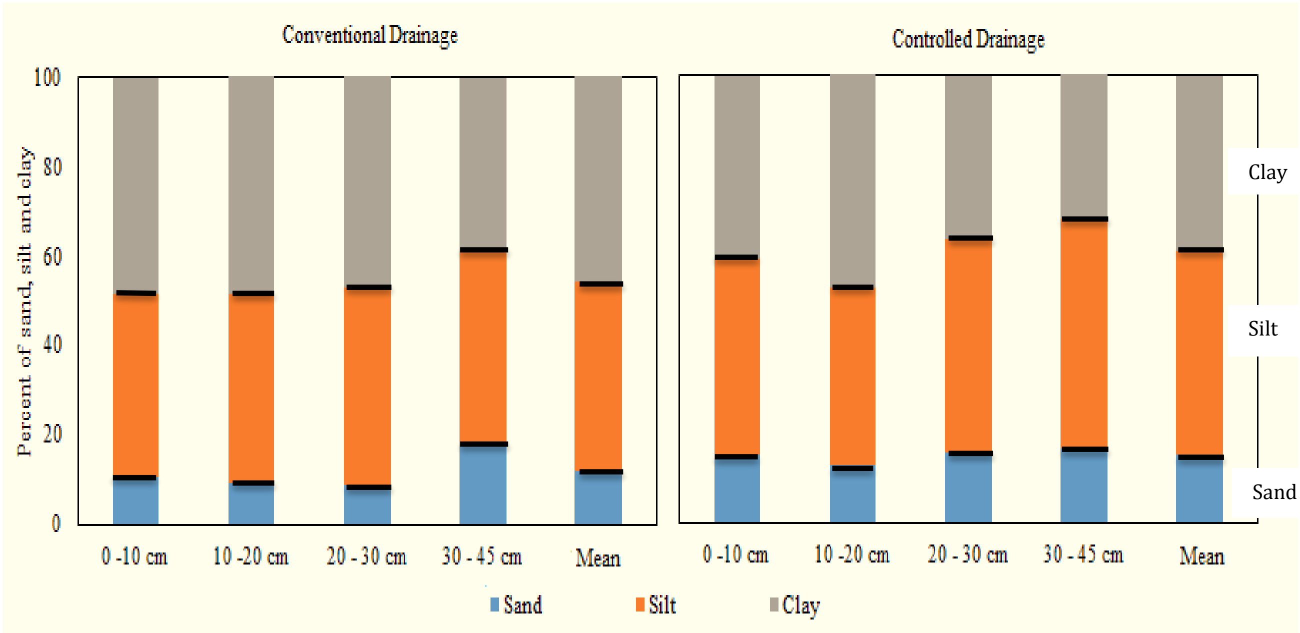

Figure 7. Soil mechanical texture of controlled and conventional drainage plots at South Dakota State University – Southeast Research Farm near Beresford, South Dakota.

Soil Bulk Density

Soil samples were collected during the summer of 2016 for dry bulk density analysis at four different depths (2 cm, 12 cm, 28 cm , and 48 cm). Soil dry bulk density in the conventional drainage plot ranged from 1.19 to 1.49 g/cm^3 (2 cm depth), 1.37 to 1.48 g/cm^3 (12 cm depth), 1.46 to 1.62 g/cm^3 (28 cm depth), and 1.43 to 1.63 g/cm^3 (48 cm depth). For the controlled drainage plot, the soil dry bulk density ranged from 1.15 to 1.51 g/cm^3 (2 cm depth), 1.35 to 1.54 g/cm^3 (12 cm depth), 1.31 to 1.62 g/cm^3 (28 cm depth), and 1.31 to 1.60 g/cm^3 (48 cm depth). The mean dry bulk density of soil at all four depths for the controlled and conventional drainage plot is presented in Figure 8. While there was no statistically significant difference in the means of the bulk density at all four depths between the controlled and conventional drainage plots, dry bulk density of the conventional drainage plot appears slightly higher than dry bulk density in the controlled drainage plot.

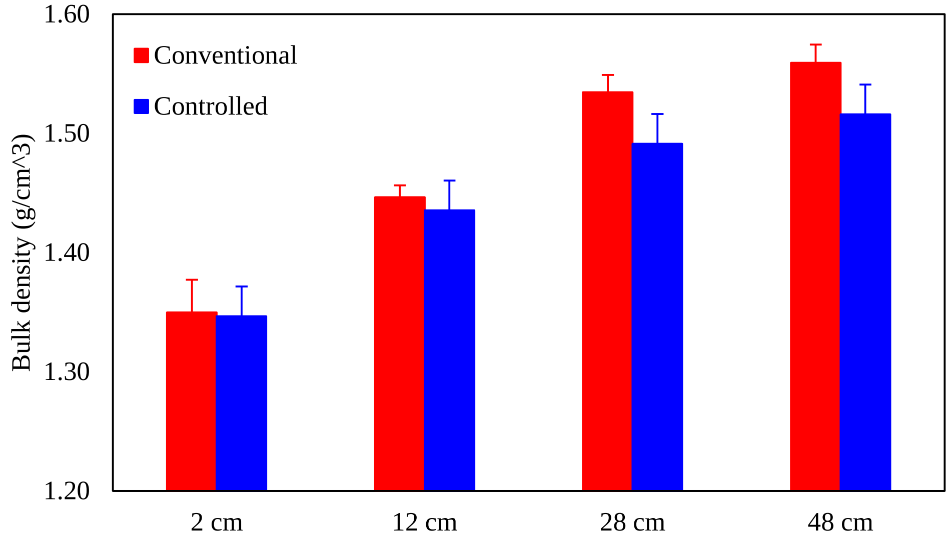

Figure 8. Mean dry bulk density at 2 cm, 12 cm, 28 cm, and 48 cm depths in the controlled and conventional drainage plots at South Dakota State University – Southeast Research Farm near Beresford, South Dakota.

Soil pH

The soil pH ranged from 6.6 to 8.0 with a mean pH of 7.30 in the conventional drainage plot, and from 6.9 to 7.9 with a mean pH of 7.59 in the controlled drainage plot. Mean soil pH was consistently greater at four depths (0-10 cm, 10-20 cm, 20-30 cm and 30-45 cm) for the conventional drainage plot compared to the controlled drainage plot (Figure 9). Overall, the mean soil pH of the controlled drainage plot was higher than the pH of the conventional drainage plot with a statistically significantly difference of 0.29 ($p < 0.05$).

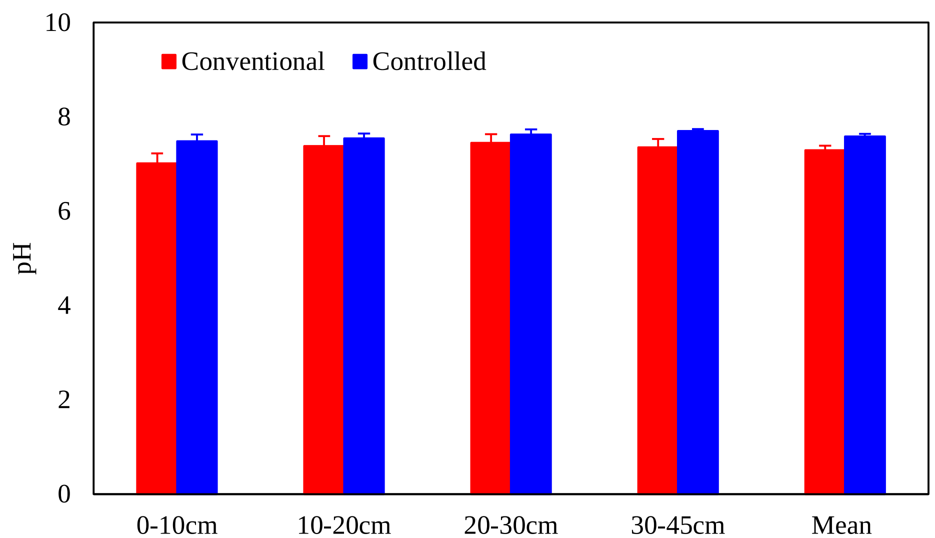

Figure 9. Mean soil pH of conventional and controlled drainage plot at South Dakota State University – Southeast Research Farm near Beresford, South Dakota.

Soil Moisture

Soil moisture content was collected continuously at two separate locations (near plot outlet and middle of plot) in both the controlled and conventional drainage plots. The descriptive statistics of the daily soil moisture content near the plot outlet is presented in Table 2. Daily soil moisture content was statistically significantly higher in the conventional drainage plot compared to the controlled drainage plot at 15 and 76 cm depths ($p < 0.05$), but statistically significantly higher in the controlled drainage plot at 105 cm depth ($p < 0.05$). This was not expected as conventional drainage removes more water from the soil profile, leading to lower moisture content compared to controlled drainage.

Table 2. Descriptive statistics of soil moisture content at the outlet of conventional and controlled drainage plots located at South Dakota State University – Southeast Research Farm near Beresford, South Dakota.

	Min		Mean		Max	
Depth	Conv.	Cont.	Conv.	Cont.	Conv.	Cont.
15 cm	0.13	0.12	0.26	0.24	0.43	0.41
45 cm	0.24	0.21	0.30	0.30	0.38	0.41
76 cm	0.30	0.29	0.32	0.31	0.53	0.45
105 cm	0.21	0.29	0.38	0.41	0.52	0.51

Conv: conventional drainage plot
Cont: controlled drainage plot

The seasonal variation of soil moisture content was not consistent between controlled and conventional drainage plots for measurements taken at all depths (Figure 10). There was no consistent seasonal trend in soil moisture observed at the four depths; however, the daily soil moisture content increased with an increase in depth in both the controlled and conventional drainage plots. The difference between the soil moisture content between controlled and conventional drainage was minimal at all four depths, except for the 105 cm depth after June 2016. The large difference in soil moisture content between the controlled and conventional drainage plot at the 105 cm depth after June 2016 may likely be due to the drainage of excess water in the spring and the high evapotranspiration demand of the crop in the conventional drainage plot, leading to substantial decreases in soil moisture. The soil moisture content at shallower depths responded to precipitation events during dry periods. For example, the moisture content at the 15 cm depth increased during June, July, and August of 2016 after each precipitation event.

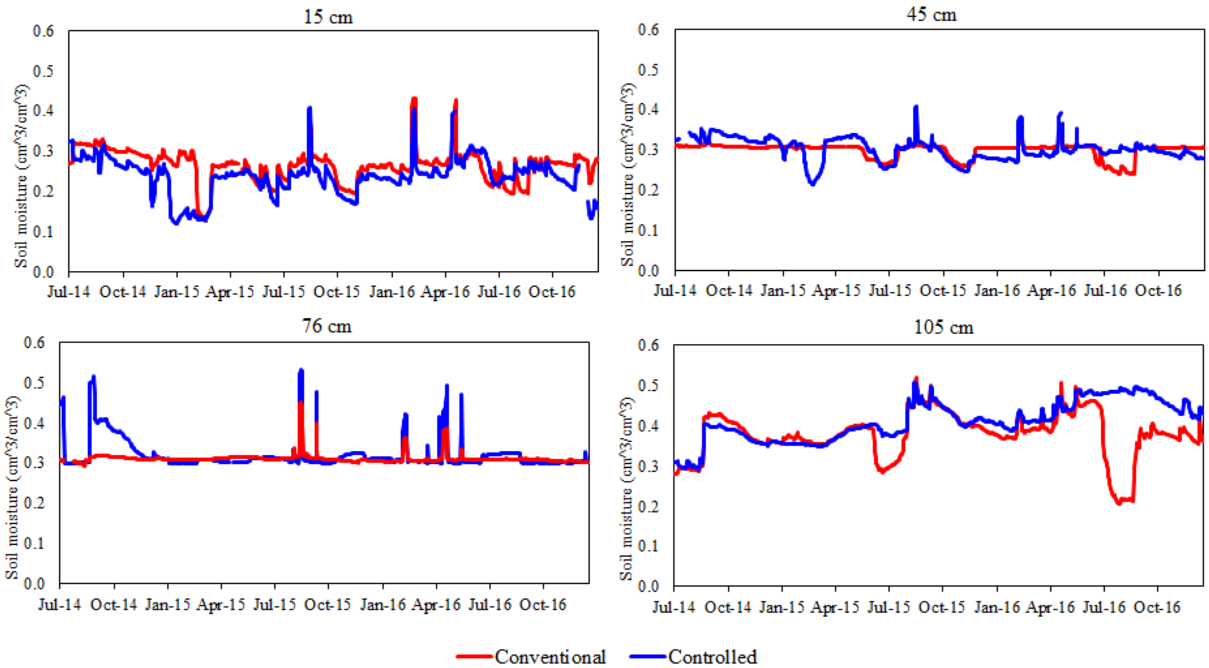

Figure 10. Daily soil moisture content at 15 cm, 45 cm, 76 cm and 105 cm depths near the outlet of conventional and controlled drainage plots located at South Dakota State University – Southeast Research Farm near Beresford, South Dakota.

The descriptive statistics of soil moisture content in the middle of the plots are shown in Table 3. The difference in mean soil moisture content was statistically significantly higher in conventional drainage compared to controlled drainage at the 10 cm, 40 cm, 60 cm, and 100 cm depths, while controlled drainage has statistically significantly higher soil moisture at the 20 cm depth ($p < 0.05$). The pattern in soil moisture content in the middle of the plots was not consistent with soil moisture near the plot outlet for corresponding depths. The reason for the higher soil moisture content at the 10 cm, 40 cm, 60 cm, and 100 cm depths in the middle of the conventional drainage plot compared to soil moisture in the controlled drainage plot is unknown.

Table 3. Descriptive statistics of soil moisture content at middle of conventional and controlled drainage plots located at South Dakota State University – Southeast Research Farm near Beresford, South Dakota.

	Min		Mean		Max	
Depth	Conv.	Cont.	Conv.	Cont.	Conv.	Cont.
10 cm	0.09	0.12	0.30	0.28	0.43	0.41
20 cm	0.07	0.14	0.32	0.36	0.43	0.47
40 cm	0.23	0.16	0.32	0.29	0.41	0.50
60 cm	0.38	0.26	0.46	0.35	0.64	0.49
100 cm	0.40	0.31	0.45	0.41	0.53	0.48

Conv: conventional drainage plot
Cont: controlled drainage plot

Similar to the soil moisture content near the plot outlets, the seasonal variation in soil moisture content at the middle of the plots was also not consistent in both controlled and conventional drainage plots (Figure 11). The difference in daily soil moisture content between the controlled and conventional drainage plots was quite visible at all five depths, while there was minimal difference in soil moisture content near the plot outlets compared to the middle of plots. The maximum difference in soil moisture content was measured at the 60 cm depth, while the minimum difference was measured at the 10 cm depth.

There was also inconsistency in the daily soil moisture content between the two locations (i.e. outlet and middle of plots) and their corresponding depths during the study period. For example, the soil moisture content in the conventional drainage plot was higher at the 15 cm depth near the plot outlet, while controlled drainage has higher daily soil moisture content at the 20 cm depth.

Drainage management of the controlled drainage plot during the growing season is similar to a no drainage condition. The study shows variability in soil moisture content near the outlet and middle of both drainage plots at all depths. The conventional drainage plot has higher soil moisture content compared to the controlled drainage plot at all depths for both locations (i.e. plot outlet and middle), except at the 105 cm depth near the plot outlet and the 20 cm depth in the middle of the plots. These findings were not expected as the controlled drainage plot should hold more water in the soil profile and should subsequently have higher soil moisture content compared to the conventional drainage plot. Further monitoring and analysis are needed to better understand water fluxes in the study plots.

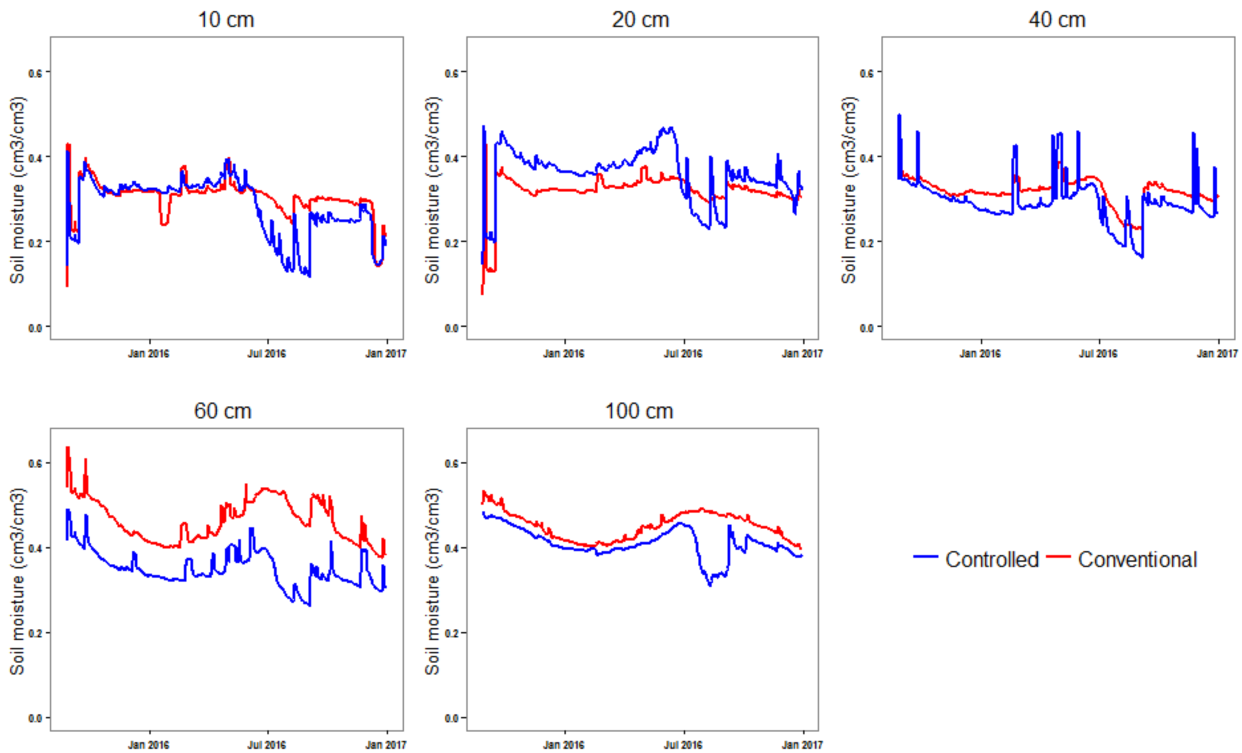

Figure 11. Daily soil moisture content at 10 cm, 20 cm, 40 cm, 60 cm, and 100 cm depths in middle of conventional and controlled drainage plots located at South Dakota State University – Southeast Research Farm near Beresford, South Dakota.

Soil Temperature

Similar to soil moisture content, soil temperature values were continuously collected near the outlet and middle of both the controlled and conventional drainage plots. Figure 12 shows the soil temperature near the plot outlets for both the controlled and conventional drainage plots. The mean soil temperature ranged from 14.2˚C to 14.5˚C, from the 15 cm to 105 cm depth, in the conventional drainage plot, and from 14.6˚C to 14.5˚C, from the 15 cm to 105 cm depth, for the controlled drainage plot during the study period. The differences in mean soil temperature between the controlled and conventional drainage plots were not statistically significant for all four depths (15 cm, 45 cm, 76 cm, 105 cm) ($p > 0.05$). Soil temperature showed consistent seasonal trend in both the controlled and conventional drainage plots. Low soil temperature was measured during the winter season, while high soil temperature was measured during the summer season at both drainage plots. With an increase in depth, the difference between the highest and lowest seasonal soil temperature was reduced in both drainage plots. The largest variation in daily mean soil temperature was observed at the 15 cm depth; but generally the soil temperature decreased with increased depth. Soil temperature dropped below 0˚C at the 15 cm and 45 cm depths during the winter season, while soil temperature approached 30˚C during the summer at the 15 cm depth.

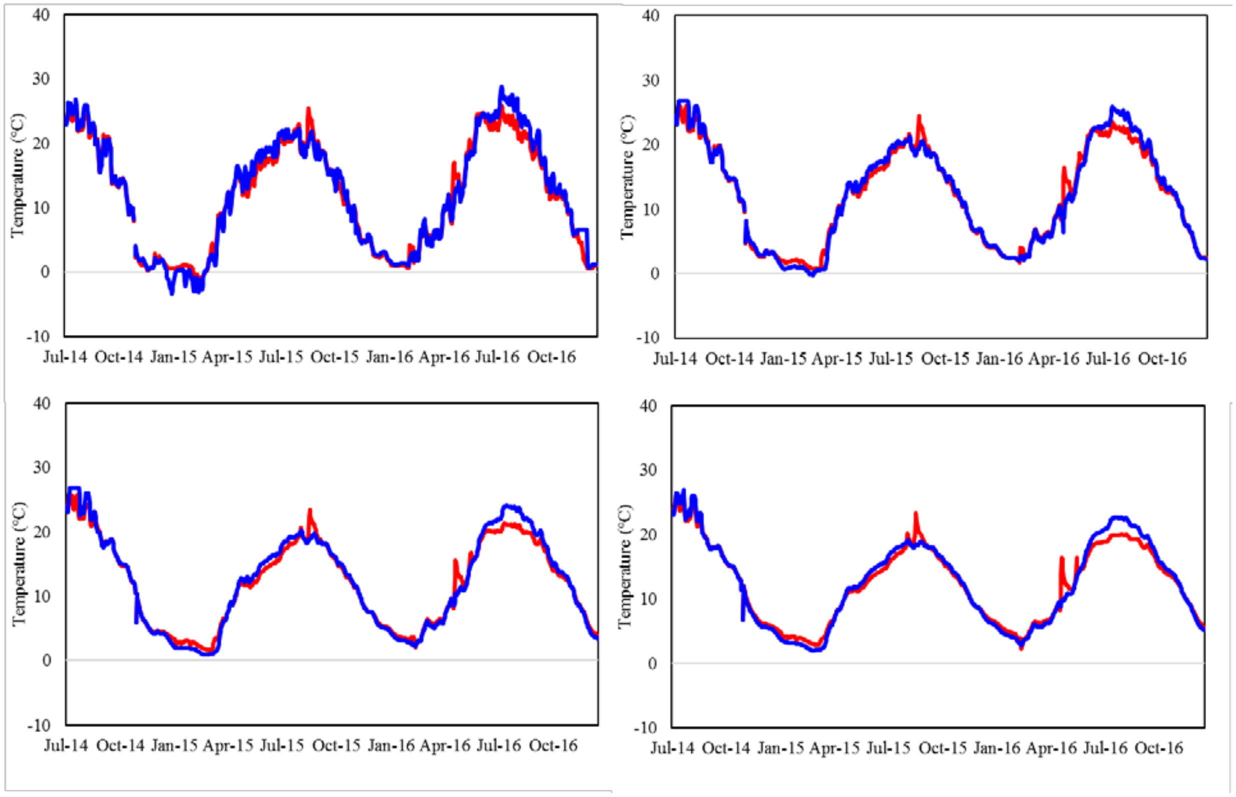

Figure 12. Soil temperature at 15 cm, 45 cm, 76 cm and 105 cm depths near the outlet of conventional and controlled drainage plots located at South Dakota State University – Southeast Research Farm near Beresford, South Dakota.

Soil temperature in the middle of the controlled and conventional drainage plots is presented in Figure 13. The mean soil temperature near the plot outlet ranged from 11.9˚C to 12.8˚C from 10 cm to 100 cm depth in conventional drainage, and from 11.6˚C to 12.5˚C from 10 cm to 100 cm depth for the controlled drainage plot during study period. The difference in daily mean soil temperature between the controlled and conventional drainage plots was not statistically significant ($p > 0.05$) for all five depths (10 cm, 20 cm, 40 cm, 60 cm and 100 cm). Soil temperature in the middle of both plots exhibited seasonal trends similar to the results near the plot outlet. During the winter season, the soil temperature dropped below 0˚C, and increased to approximately 30˚C at shallower depths during the summer season for both the controlled and conventional drainage plots. Daily fluctuation of soil temperature was prominent at 10, 20 and 40 cm depths. Fluctuation of daily soil temperature was minimal at 60 and 100 cm depths. The difference in temperature between the controlled and conventional drainage plots was minimal at all five depths.

This study showed no statistically significant difference in the mean soil temperature between controlled and conventional drainage practices ($p > 0.05$). The adjacent drainage plots likely influence the lateral water movement, creating similar soil water characteristics in both plots.

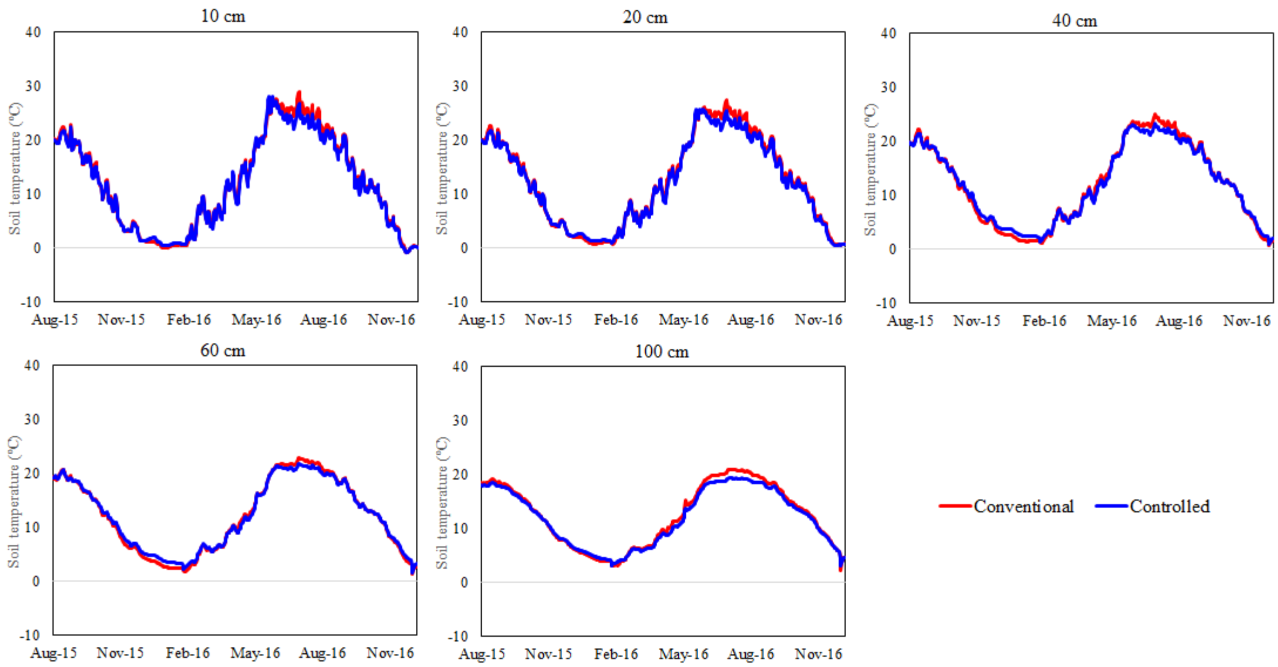

Figure 13. Soil temperature at 10 cm, 20 cm, 40 cm, 60 cm and 100 cm depths in middle of conventional and controlled drainage plots located at South Dakota State University – Southeast Research Farm near Beresford, South Dakota.

Soil Nitrate

Soil samples were collected in 2016 after harvesting corn to measure residual soil nitrate, which ranged from 2 to 42 mg/kg with a mean of 12.74 mg/kg in the conventional drainage plot, and from 7 to 78 mg/kg with a mean of 24.74 mg/kg in the controlled drainage plot (Figure 14). The mean residual nitrate content at all four depths (0-10 cm, 10-20 cm, 20-30 cm, and 30-45 cm) was not statistically significant ($p > 0.05$); however, the overall mean residual soil nitrate content was statistically significantly higher in the controlled drainage plot compared to the conventional drainage plot ($p < 0.05$). Mean residual soil nitrate in the conventional drainage plot decreased with an increase in soil sampling depth, while in the controlled drainage plot the residual soil nitrate did not show any pattern with an increase in sampling depth.

For the controlled drainage plot, the mean residual soil nitrate was lower at the soil surface and had inconsistent mean residual soil nitrate with an increase in depth.

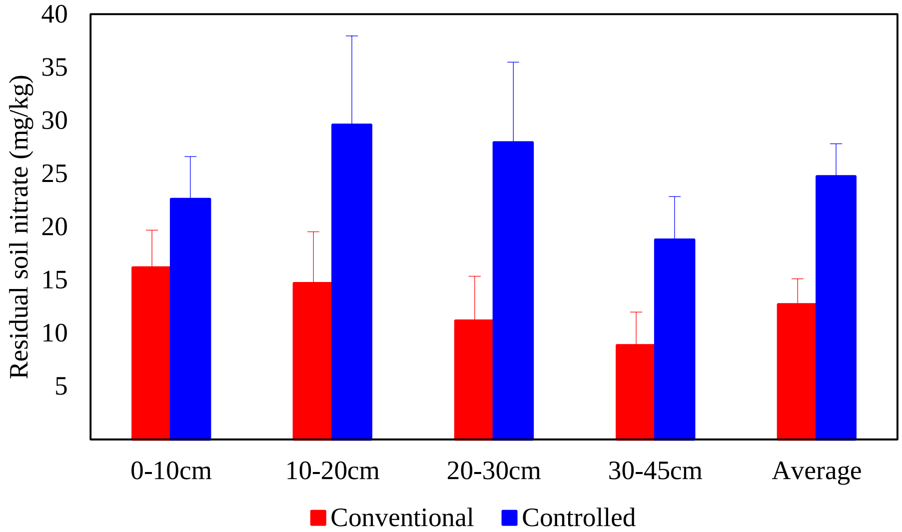

Figure 14. Residual soil nitrate content in the controlled and conventional drainage plots located at South Dakota State University – Southeast Research Farm near Beresford, South Dakota.

Soil Penetration Resistance

The soil penetration resistance in the conventional drainage plot ranged from 642 to 4147 KPa with a mean of 1526 KPa, and from 440 to 4587 KPa with a mean of 1488 KPa for the controlled drainage plot during the study period. The mean soil penetration resistance did not exhibit any specific pattern (Figure 15). Mean soil penetration resistance between the controlled and conventional drainage was not statistically significant ($p > 0.05$). However, there was seasonal patterns in soil penetration resistance for both the controlled and conventional drainage plots. Soil penetration resistance was lower during the spring and fall seasons when soil was relatively wetter due to precipitation and spring snow melt. Penetration resistance gradually increased during summer (i.e. June, July and August) when soil was drier due to crop evapotranspiration demands.

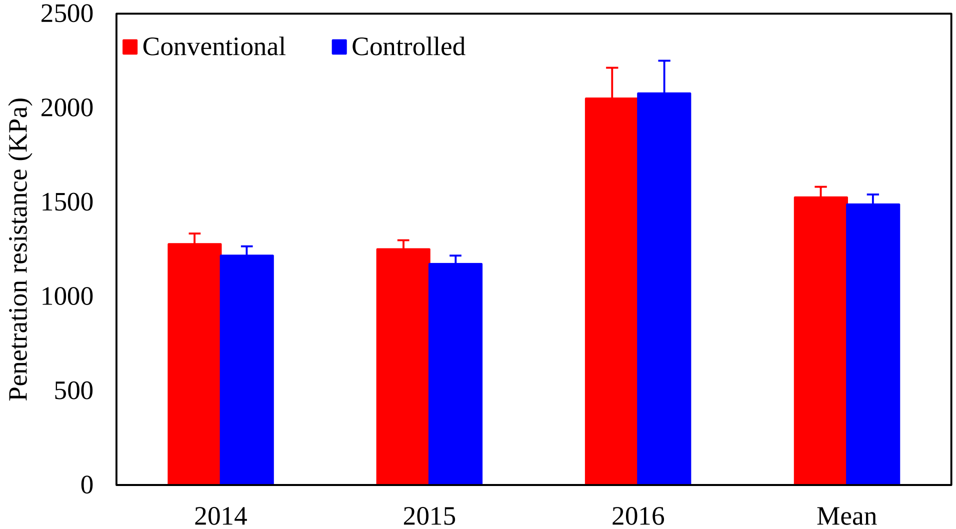

Figure 15. Annual soil penetration resistance in the controlled and conventional drainage plots located at South Dakota State University – Southeast Research Farm near Beresford, South Dakota.

Crop Yield

Soybean, Oats, and Corn were planted in 2014, 2015 and 2016, respectively. Crop yields in the conventional drainage plot were 3.6, 9.9 and 13.0 ton/ha, and they were 3.3, 10.4 and 11.9 ton/ha in the controlled drainage plot for 2014, 2015, and 2016, respectively. There were 7.6% and 9.2% reductions in soybean and corn yields in the controlled drainage plot during 2014 and 2016, while a 5.4% increase in oat yield was observed in 2015.

Leaf Area Index

The descriptive statistics of LAI during the study period are presented in Table 4. The difference in mean LAI was not statistically significant ($p > 0.05$); however, the controlled drainage plot has slightly higher LAI compared to LAI from the conventional drainage plot during all three study years (2014 to 2016). The LAI measurement was within the range of 0 to 6.5 m^2/m^2 for corn and 0 to 5.5 m^2/m^2 for soybean irrigated fields in Nebraska (Nguy-Robertson et al., 2012). The LAI gradually increases with increase in growth stage of the crop. The LAI measured was low during tillering stage (early June) and reached a maximum at maturity stage (mid-August). The LAI values recorded were not consistent with yield data in 2014 and 2016 when the conventional drainage plot had higher yield than the controlled drainage plot. Generally, plots with higher LAI tend to produce more biomass and subsequently should produce more yield; but this was not the case in this study. Further study is needed to understand the relationship between crop yield and LAI in the controlled and conventional drainage plots.

Table 4. Descriptive statistics of leaf area index in controlled and conventional drainage plots located at South Dakota State University – Southeast Research Farm near Beresford, South Dakota.

	Min		Mean		Max	
Year	Conv.	Cont.	Conv.	Cont.	Conv.	Cont.
2014 (Soybean)	4.72	5.13	5.08	5.46	5.44	5.8
2015 (Oats)	3.95	4.49	4.89	5.13	5.67	5.97
2016 (Corn)	0.53	0.47	3.57	3.84	5.88	6.27

Conv: conventional drainage plot
Cont: controlled drainage plot

See reports from previous years for more detailed nitrate and corn yield data.

ACKNOWLEDGEMENT
This research was supported by the South Dakota Corn Utilization Council, the Minnesota Corn Research and Promotion Council, the South Dakota Board of Regents and the National Institute of Food and Agriculture through the South Dakota State University Agricultural Experiment Station. The work was conducted wholly or in-part at the Southeast Research Farm Field Station of SDSU AES. We wish to acknowledge the assistance of additional in-kind support provided by Advanced Drainage Systems, Inc. and Agri Drain Corporation.

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Corn and Soybean Yield Responses to Tillage and Residue Management in 2017

Howard J. Woodard* and Brad Rops

INTRODUCTION

A long-term corn and soybean rotation was established in 2010 to determine the influence of tillage and residue management treatments on grain yields. The location of the corn and soybean plots alternated each year within the same site area in the northeastern quarter of the Southeast Research Farm. The main soil on the research site was determined to be an Egan/Trent soil with a silty clay loam textural class (22% sand, 31% silt, 47% clay) and with 3.9% organic matter.

The study was implemented with two levels of tillage (no-till and conventional-till), and two levels of corn residue management (corn residue-removed and residue-retained). After grain was harvested from the research site in the fall of 2016, plots for next growing season were prepared by removing corn residue from selected treatment plots with a commercial rake and baler owned by the research farm. About 80-90% of the corn residue was removed from the "residue removed" treatment plots in this process and the surface of the plot area was generally clean. (No soybean residue was removed from soybean plots). A chisel-plow operation was applied to the conventional-tilled treatment plots afterwards. In the spring of 2017, a field cultivator operation prepared the seed bed in the conventional-tilled plots for both the corn and soybeans. Corn seed was planted in late April with 30" row spacing at a rate of 32,000 seeds/a. Soybean seed was planted in mid-May in 30" rows at a rate of 150,000 seeds/a. No P and K fertilizer was applied since the soil test P and K levels were medium-high and we needed to document the nutrient balances of the various treatment plots. N was applied as 28-0-0 to support a yield of about 180 bu/a. Grain from both crops was harvested in October at physiological maturity and final grain yields were estimated on an acre basis at 15% moisture for corn and 13.5% for soybeans.

RESULTS

The overall mean corn grain yield range in 2017 was about 30 bu/a below the five-year corn grain yield average for the region (Table 1). The summer was characterized by warm weather throughout the growing season, but was not excessively hot. Rainfall amounts were about average for April and May. However, June and July precipitation was lower than normal and certainly contributed to lower than average yields. Because of the lower yield potential due to low precipitation, there was no statistical significance between treatments.

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Table 1. Corn grain yield response to tillage and residue management treatments at SERF, Beresford, SD, in 2017.

Tillage	Corn Residue Management: Removed (2015)	Retained	$LSD_{(.05)}$
	bu/a	bu/a	bu/a
No-Till	143.5	146.6	N.S.
Conventional	144.4	148.6	N.S.
$LSD_{(.05)}$	N.S.	N.S.	

N.S. indicated statistical non-significance at the alpha = .05 level.

The overall mean soybean grain yield range was about 10-15 bu./a lower than the five-year grain soybean yield average for the region (Table 2). Neither the tillage treatment nor the residue management treatment (corn residue removed from the previous year) had any influence on final grain yield probably because of the lower precipitation.

Table 2. Soybean grain yield response to tillage and residue management treatments at SERF, Beresford, SD, in 2017.

Tillage	Corn Residue Management: Removed (2016)	Retained	$LSD_{(.05)}$
	bu/a	bu/a	bu/a
No-Till	50.7	53.8	N.S.
Conventional	47.1	50.5	N.S.
$LSD_{(.05)}$	N.S.	N.S.	

N.S. indicated statistical non-significance at the alpha = .05 level.

SUMMARY

There was a no clear advantage of conventional-till vs. no-till, or the either residue management treatment on soybean yields during this cropping season. Since the yield potential for corn grain production was lowered due to lower precipitation levels received, there was no apparent relevance for comparing any of the tillage-residue management combinations on corn grain yield.

ACKNOWLEDGEMENT

The authors appreciate the contributions of the South Dakota Agricultural Experiment Station in Brookings, SD to support this project.

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Influence of Several Soybean In-Furrow and Foliar Products on Soybean Grain Yield at the Southeast Research Farm in 2017

Anthony Bly*, Sara Berg, and David Karki

INTRODUCTION

Soybean producers are faced with many agronomic input choices when growing soybeans. This research study investigates a few of these products.

OBJECTIVE

Evaluate several soybean growth enhancement products effects on soybean grain yield.

SUMMARY

Product treatment significantly influenced soybean grain yield (Table 2). The least significant difference between treatment averages was 5.1 bu/a and could not be used to explain treatment differences due to the control treatment (water only) occurred in the middle of the treatment yield range. Some of the treatments had significantly lower yields when compared with other treatments and the control.

ACKNOWLEDGMENTS

This research project partially funded by West Central, SDSU Extension, SD Ag Experiment station and the Southeast Research Farm.

Mention of proprietary product does not imply endorsement. This research conducted with un-biased and scientifically sound methods.

Table 1. Materials and Methods (Soybeans):

Item:	Description:
Planting date:	June 9
Variety (seeding rate):	Asgrow AG2035 (150,000 seeds/a)
Herbicides: Post 1 (July 6)	Flexstar (10 oz/a), Firstrate (0.3 oz/a), Select (6 oz/a)
Post 2 (August 1)	Glyphosate (32 oz/a)
In-furrow products:	Soyshot and Unlocked
Foliar products: (application, see Table 1)	Levisol, Unlocked, WC101 and Tachline
Plot size:	15 x 30 ft.
Fertilizer Nutrients: broadcast (April 13)	144 lbs/a as 11-52-0 and 20 lbs S/a as AMS
Tillage (row spacing):	No-till (30 inches)
Harvest Date:	October 26
Statistics:	SAS/ANOVA with LSD

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Table 2. Influence of several West Central Products on soybean grain test weight and grain yield at the Southeast Research Farm near Beresford SD in 2017. Anthony Bly and Sara Berg (SDSU Extension)

			Grain	
Product(s) name(s)	Product rate	Application method	Test weight	Yield
			lbs/bu	bu/a
Control (Water)	6 gpa	In-furrow[A]	53.7	58.5 a
Soyshot	2 gpa	In-furrow	54.0	57.7 ab
Soyshot/Unlocked	2 gpa + 2 oz/a	In-furrow	52.9	62.6 a
Levisol	64 oz/a	Foliar[B]	54.0	59.6 a
Soyshot + Levisol	2 gpa + 64 oz/a	In-furrow + Foliar	53.1	52.0 c
Soyshot/Unlocked	2 gpa + 2 oz/a	In-furrow	53.6	57.7 ab
+ Levisol	64 oz/a	Foliar		
Levisol + Unlocked	64 oz/a + 2 oz/a	Foliar	53.6	60.6 a
Soyshot	2 gpa	In-furrow	54.4	56.9 abc
Levisol + Unlocked	64 oz/a + 2 oz/a	Foliar		
Soyshot +	2 gpa + 2 oz/a	In-furrow	52.5	53.2 bc
Unlocked	64 oz/a + 2 oz/a	Foliar		
Levisol + Unlocked				
WC101 + Tachline	16 oz/a + 32 oz/a	Foliar	54.2	57.0 abc
		$LSD_{(.05)}$	NS	5.1
		Pr>F	0.57	0.01
		CV	2.3	6.1

[A] All in-furrow application volumes made in total volume of 6 gpa balanced with water.
[B] All foliar application volumes made in a total volume of 20 gpa balance with water with flat fan nozzles on July 30 at R2 growth stage.

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Commence Seed Treatment Effects on Hard Red Spring Wheat and Soybeans at the Southeast Research Farm During 2017

Anthony Bly* and Sara Berg

OBJECTIVE

Determine the influence of Commence seed treatments on hard red spring wheat and soybean grain yield.

SUMMARY

Commence liquid seed treatment was very easy to apply to seeds in a small cement mixer. Seeds dried fairly quickly and did not cause any bridging or other planting issues. Grain yield for both spring wheat and soybeans were not significantly influenced by Commence seed treatment (Tables 2 and 3).

ACKNOWLEDGEMENTS

These projects partially funded by Ralco Nutrition, SDSU Extension, SD Agriculture Experiment Station and the Southeast Research Farm.

Mention of proprietary product does not imply endorsement. This research conducted with un-biased and scientifically sound methods.

Table 1. Materials and Methods (Spring Wheat):

Item:	Description:
Planting date:	April 10
Variety (seeding rate):	Prevail (110 lbs/a)
Commence rate/100 lbs seed:	4 oz
Herbicides: Burndown	32 oz/a glyphosate, April 11
Post	16 oz/a Bronate, June 1
Plot size:	15 x 600 ft.
Fertilizer Nutrients (application method)	150 lbs N/a as broadcast urea
Fertilizer application date:	April 11
Tillage (row spacing):	No-till (7.5 inches)
Harvest Date:	August 11
Statistics:	SAS/ANOVA with LSD

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Table 1 Continued: Materials and Methods (Soybeans):

Item:	Description:
Planting date:	June 9
Variety (seeding rate):	Asgrow AG2035 (150,000 seeds/a)
Commence rate/100 lbs seed:	6 oz
Herbicides: Post 1 (July 6)	Flexstar (10 oz/a), Firstrate (0.3 oz/a), Select (6 oz/a)
Post 2 (August 1)	Glyphosate (32 oz/a)
Plot size:	15 x 300 ft.
Fertilizer Nutrients: broadcast (April 13)	144 lbs/a as 11-52-0 and 20 lbs S/a as AMS
Tillage (row spacing):	No-till (30 inches)
Harvest Date:	October 26
Statistics:	SAS/ANOVA with LSD

Table 2. Influence of Commence Seed Treatment on Spring Wheat Grain Yield at the Southeast Research Farm in 2017.

Commence Treatment	Grain Yield
	bu/a @ 13% moisture
Check	56.8
Treated[A]	58.5
Pr>F	0.59
CV (%)	6.9
LSD	NS

[A] 4 oz/100 lbs seed.
CV = coefficient of variation, LSD = Least significant difference
NS = non-significant

Table 3. Influence of Commence Seed Treatment on Soybean Yield at the Southeast Research Farm in 2017.

Commence Treatment	Grain Yield
	bu/a @ 13% moisture
Check	52.1
Treated[A]	50.7
Pr>F	0.23
CV (%)	2.6
LSD	NS

[A] 6 oz/100 lbs seed.
CV = coefficient of variation, LSD = Least significant difference
NS = non-significant

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Influence on N Rate and Urease Inhibitors on Corn Ear Leaf N Concentration and Grain Yield Near Garretson, SD in 2017

Anthony Bly*, David Karki,
and Sara Berg

INTRODUCTION

Urea volatilization can be an issue when urea fertilizer remains on the soil surface. Urease inhibitors do exist to reduce activity for a few days until precipitation occurs to move urea into the soil. New technologies are developed and require evaluations.

OBJECTIVE

To evaluate the efficacy of new urease inhibitors to reduce urea volatilization potential.

RESULTS AND DISCUSSION

Treatment applications were made on June 8, 2017 after waiting for a 20% or less chance of precipitation in the 5 day forecast for the region around Sioux Falls, SD. The soil surface on the day of treatment application was very dry. No precipitation was received until 5 days later on June 13, 2017 Soil sample results showed high organic matter (4.9) which decreased with soil depth, 65.2 lbs of nitrate-N in the top two feet of soil, very high Olsen P and extractable K in the top 3 inches, pH of 5.1 in the surface, and adequate zinc and other nutrients as well (Table 2). Ear leaf nitrogen content was significantly influenced by N rate (Table 3). Grain was not significantly influence by treatment (Table 3), however, single factor statistical analysis by nitrogen rate showed a significant effect (data not shown). Overall grain yield means were very good and exceeded 200 bu/a except for plots without nitrogen.

ACKNOWLEDGMENTS

This research project was partially funded by Koch LLC, SDSU Extension and the South Dakota Agriculture Experiment Station.

Mention of proprietary product does not imply endorsement. This research conducted with un-biased and scientifically sound methods.

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Table 1. Materials and Methods

Item	Description
Location	East Central Minnehaha County SD
GPS location: (Lat,Lon)	43.6583, 96.477864
Elevation (ft)	1550
Corn planting date (population)	May 13, 2017 (32,500)
Corn Hybrid (RM)	Mustang 0995 (95)
Tillage method	No-till since 1992
Row Spacing	30 inches
Treatment application date (corn growth stage)	June 8, 2017 (V4)
Plot size	15 x 30 feet
Soil conditions at treatment application	Very dry.
Pre-Project soil samples depths	0-1, 1-2, 2-3, 3-4, 4-5, 5-6, 0-6 and 6-24
Soil sample analyses.	NO_3-N, Olsen P, ext. K, pH, SO_4-S, Zn, B,Cu,Ca,Mg,Mn
Precipitation	CoCoRHAS guage near plots < 1000 ft
Air Temperature	Sioux Falls, SD (15 miles)
N source	Urea
Urea treatments	Agrotain Advanced (KAA) and KAS 072K19 (K19)
Treatment application rate	64 oz/ton for both treatments
Urea/treatment application method	Surface broadcast
N rates	0, 60, 120, 180, 240
Corn plant tissue	ELN (ear leaf total N concentration)
Corn grain yield	Harvest area = 20ft of row/plot
Statistics	ANOVA (SAS)

Table 2. Soil samples analysis for several parameters from the Koch LLC urease inhibitor study in southeast South Dakota in 2017.

Soil Depth	OM	NO_3N		Olsen P	K	pH	SO_4S		Zn	Cu	Mn	Ca	Mg	B
inches	%	ppm	lba/a	----- ppm -----			ppm	lbs/a	-------------------- ppm --------------------					
0-6	4.9	11.6	23.2	34	251	5.1	4.7	9.4	1.79	1.1	32.2	1640	352	0.8
6-24		7	42				4.3	25.8						
0-1	5.4	14.2	28.4	55.4	428	5.1	4.5	9.0	2.61	0.99	41.2	1313	295	0.79
1-2	4.6	6.2	12.4	31.4	285	5.0	4.9	9.8	1.31	1.11	40.9	1373	291	0.55
2-3	4.3	6.4	12.4	17.1	206	5.2	4.7	9.4	0.92	1.01	32.0	1519	318	0.60
3-4	4.1	6.4	12.4	8.8	160	5.4	4.3	8.6	0.70	0.98	26.2	1774	366	0.65
4-5	4.1	5.4	10.8	6.3	121	5.6	4.5	9.0	0.64	0.89	23.1	1854	378	0.77
5-6	4.1	6.2	12.4	6.3	103	5.6	4.0	8.0	0.92	0.86	21.6	1768	364	0.68

Table 3. Influence of Agrotain Advanced and experimental urease inhibitor on corn ear leaf total N and grain yield in Southeast South Dakota in 2017.

Treatment No.	Product[A]	Nrate	ELN[B]	Grain Yield
		lbs/a	%N	bu/a @ 15%
1	Urea only	0	2.29 f	188.38
2	K19	60	2.82 de	207.93
3	K19	120	3.00 abcde	225.62
4	K19	180	3.18 abc	218.67
5	K19	240	3.25 ab	222.74
6	KA	60	2.76 e	212.33
7	KA	120	2.97 bcde	219.61
8	KA	180	3.13 abc	229.24
9	KA	240	3.13 abcd	214.72
10	Urea only	60	2.91 cde	214.72
11	Urea only	120	3.09 abcd	219.98
12	Urea only	180	3.30 a	235.45
13	Urea only	240	3.29 a	227.60
Pr>F			0.001	0.06
CV (%)			7.2	7.8
LSD $_{(.05)}$			0.31	NS

[A] K19 = KAS 072K19, KA = Agrotain Advanced
[B] ELN = ear leaf nitrogen
Treatment means with similar lower case letter are not significantly different
NS = non-significant.

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Seed Placed P Influence on Soybean Plant Population and Grain Yield Near Garretson, SD in 2017

Anthony Bly*

OBJECTIVE

Determine the influence of seed place P on soybean plant population and grain yield.

SUMMARY

Phosphorus placement with seed at planting as 0-46-0 (triple super phosphate) did not significantly increase soybean grain yield or reduce plant population (Table 2). Grain yield was numerically greater with applied P, however individual treatment replicate yield variability was too great for statistics to separate the average treatment yield values. Soil test Olsen P was 15 ppm which is above the sufficiency level for soybeans and therefore no P application would be recommended for optimal grain yield.

ACKNOWLEDGMENTS

This on-farm research project is partially funded by the South Dakota Soybean Research and Promotion Council and SDSU Extension.

Table 1. Materials and Methods

Item	Description
Planting date	May 20
Seeding rate	162,000 seeds/a
P fertilizer source	Triple Super Phosphate (0-46-0)
P_2O_5 rate	40 lbs/a
P placement	With seed
Row spacing	10 inches
Tillage	No-till
Variety	Asgrow AG1935
Replications	4
Plot size	30 ft x 300 ft
Statistics	4 reps, SAS, ANOVA
Soil samples	0-6 inch prior to planting

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Table 2. Seed placed P, Minnehaha County, 2017. (Anthony Bly, Soils Field Specialist, SDSU Extension, Sioux Falls Regional Center)

Treatment Comparison	Harvest population	Grain Yield
	plants/a	bu/a @ 13%
Control	149,408	59.49
40 lbs P_2O_5[A]	160,614	62.61
Statistics: 4 replications		
Pr>F[B]	0.22	0.23
CV(%)[C]	6.5	4.9
$LSD_{(.05)}$[D]	NS	NS

Planting date = May 20, Variety = Asgrow 1935, 10 inch rows seeded at 162,000 seeds/a. No-till, previous crop oats w/cover crop. Soil test Olsen P = 15 ppm, pH = 5.2, soil test K = 160 ppm.

[A] P applied with seed as 87 lbs 0-46-0/a.

[B] values less than 0.90 indicate that treatment averages are not significantly different.

[C] coefficient of variation, % of numerical variability compared to average. Values less than 10 are good.

[D] LSD = least significant difference comparison between treatment averages, NS=non-significant in this experiment.

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Influence of Fungicide, Plant Health Products, Foliar N, Vinegar, and High Fertilizer Nutrients on Soybean Grain Yield Near Crooks, SD During 2017

Anthony Bly* and Connie Strunk

This on-farm research project compared multiple products available to soybean producers that are marketed for plant health improvement (Fortalis and MegaFol), foliar N, vinegar for possible flower bud retention, fungicide (Stratego) for disease reduction and high soil applied nutrients for high yield potential.

SUMMARY

Treatment source of variation from statistical analysis significantly influenced grain yield at the 99% confidence limit (Pr>0.01) (Table 2). The least significant difference (LSD=3.2 bu/a) showed which treatments were significantly different from each other. Any treatment averages with similar lower case letters are not statistically significant from each other. The only treatment that was significantly higher when compared with the other treatments was the "High Fertility" treatment. Since several nutrients were applied, it is impossible to determine which nutrient could have caused the yield increase. It is speculated that since the soybean treatment with 10 gpa UAN (28-0-0, 30 lbs N/a) did not increase yield, that N was not the factor. Soil test K is 204 ppm, which is well above the sufficient level in the soil (160 ppm) and therefore not responsible for the yield increase. It is speculated that the soybean yield increase was caused by sulfur application. Prior research with sulfur on no-till soybeans has shown intermittent soybean yield responses. Further research on the sulfur influence on soybeans is recommended.

ACKNOWLEDGEMENTS

This on-farm research project partially funded by the South Dakota Soybean Research and Promotion Council and SDSU Extension.

Mention of proprietary product does not imply endorsement. This research conducted with un-biased and scientifically sound methods.

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Table 1. Materials and Methods

Item	Description
Planting Date	May 8
Variety	Mustang 19726
Seed Rate	155,000
Row Spacing	15 inches
Product rates and application timing	Table 1
Tillage method	No-till (15 years)
Plot size	5 x 30 ft
Statistics	4 replications, SAS-ANOVA
Soil Samples	0-6 inch, prior to treatment application

Table 2. Multi-Comparison Study, Minnehaha County, 2017 (Anthony Bly, Soils Field Specialist, SDSU Extension, Sioux Falls Regional Center)

Treatment Comparison	Application Date (growth stage)	Grain Yield
		bu/a @ 13%
Control		61.1 bc
Stratego YLD[A] + Fortalis[B]	July 28 (R1)	63.4 b
Stratego YLD	July 28 (R1)	62.0 bc
High Fertility[C]	May 10, (pre-emerge broadcast)	67.5 a
MegaFol[D] + UAN[E]	July 7 (V4)	62.3 bc
MegaFol	July 7 (V4)	60.1 c
Vinegar[F]	July 7 (V4)	59.7 c
Statistics: 4 replications		
Pr>F[G]		0.01
CV (%)[H]		3.5
$LSD_{(.05)}$[I]		3.2

Planting date = May 8, Variety = Mustang 19726, 15 inch rows seeded at 155,000 seeds/a. No-till, previous crop corn. Soil test Olsen P = 23 ppm, pH = 5.8, soil test K = 204 ppm.

[A] 4.5 oz/a, BAYER

[B] 14 oz/a, product supplied by PlantImpact.

[C] 200 lbs N/a as urea, 100 lbs K_2O/a as 0-0-60, 50 lbs N/a as AMS.

[D] 16 oz/a, product supplied by Helena.

[E] Urea-Ammonium-Nitrate (28-0-0) at 10 gpa with 10 gpa water.

[F] 5 gal/a concentrated Vinegar (35%) with 15 gpa water.

[G] values less than 0.90 indicate that treatment averages are not significantly different.

[H] coefficient of variation, % of numerical variability compared to average. Values less than 10 are good.

[I] LSD = least significant difference (bu/a) comparison between treatment averages.

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Water Infiltration Management System Comparison, Minnehaha County SD, April 2017.

Anthony Bly* and Al Miron

INTRODUCTION

Soil cover (armor) is very important for improved soil health and is influenced by management systems primarily controlled by tillage system, residue removal, cover crops, manure applications, and livestock grazing. Water infiltration is a quick way to indirectly measure soil health because soil aggregation and macro-pores developed under minimal soil disturbance systems and can be measured by the amount of water that enters the soil surface in a given amount of time. A simple research study was conducted on fields with varying management systems to compare water infiltration rates.

Table 1. Materials and Methods

Item	Description
Measurement date	April 7
Infiltration ring diameter	6 inch diameter and length inserted 3 inches
Water volumes	First and second 500 mL/ring = 1.14 inches each
Replications	4
Replicate arrangement	Diagonal to previous years corn rows.
Systems evaluated	No-till corn no cover crop
	No-Till corn with cereal rye cover crop
	Conventional till, silage corn w/manure
	Conventional till, silage corn w/manure + cover crop
	Conventional till, corn, residue bale, fall ripped, spring field cultivated prior to alfalfa seeding.
Soil texture	Silt loam with 2-4% slope.
Time measured	Stop watch
Measurement procedure	First 1.14 inch infiltration timed and second 1.14 inches immediately timed after first (stopwatch)

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Table 2. Management System Descriptions

Management System	Short Name	Description
No-Till Corn no cover crop	NT no CC	15 year no-till corn/soybean rotation
No-Till Corn with cover crop	NT with CC	15 year no-till corn/soybean rotation with cereal rye seeded at 70 lbs/a with airplane at corn maturity.
Conventional till, silage corn w/manure	CT no CC	Conventional tillage system, corn on corn silage with dry pack bed manure spread.
Conventional till, silage corn w/manure + cover crop	CT with CC	Conventional tillage system, corn on corn silage with dry pack bed manure spread and cover crop planted after silage harvest consisting of radish, turnips and oats.
Conventional till, corn, residue bale, fall ripped, spring field cultivated.	CT recent	Conventional tillage system, corn for grain, stalk residue bales removed, fall deep ripped, spring field cultivate seeded to alfalfa.

SUMMARY

As tillage intensity increased, the time for the first inch, second inch, and total (1000 mL) water infiltration increased (Table 3 and Figure 1). Cover crops in both the no-till and conventional tilled systems decreased the amounts of time for water infiltration. Water infiltration times for the tilled systems showed that recent fall and spring tillage greatly increased the time for water infiltration. The two corn silage systems which hadn't been tilled for about 12 months had much faster water infiltration times when compared with the more recently tilled field that was prepared for alfalfa seeding.

ACKNOWLEDGEMENTS

A special thanks to Lynn Boadwine and Al Miron for allowing SDSU Extension to measure water infiltration in their fields.

Table 3. Cropping System Water Infiltration Comparison, April 2017, Minnehaha County

				Minutes and Seconds to Infiltrate (00:00)		
Previous Crop	Tillage	Cover Crop	Manure	First 500 mL	Second 500 mL	1000 mL
corn	no	no	no	0:40	4:46	5:26
corn	no	yes[B]	no	0:27	3:51	4:18
corn silage	yes[A]	no	yes[C]	1:22	8:08	9:30
corn silage	yes[A]	yes[E]	yes[C]	0:41	4:29	5:10
Corn (stover removed)	yes[D]	no	yes[F]	9:45	27:13	36:58

[A] Previous year in preparation for corn planting
[B] cereal rye at 70 lbs/a aerial seeded prior corn harvest
[C] dry dairy manure applied in previous fall
[D] Fall Deep ripped and field cultivated prior to oats planting.
[E] Oats and Radishes seeded after silage harvest.
[F] Dairy manure applied in previous years.

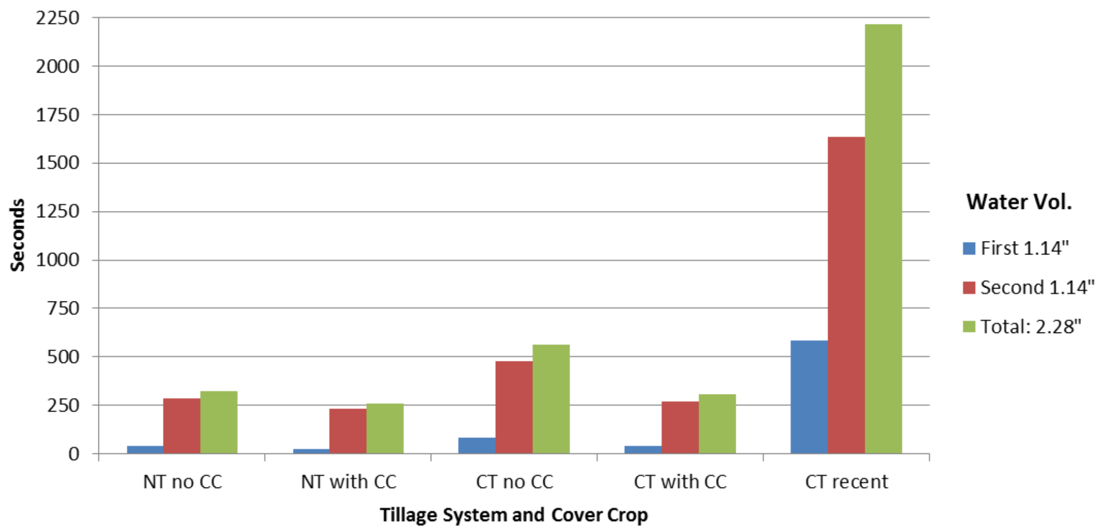

Figure 1. Cropping Systems Water Infiltration Comparison, April 2017, Minnehaha County, South Dakota

SDSU Extension, Bly 2017

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Evaluating Soil Nutrient Management Concepts for Corn in Eastern South Dakota in 2017

Anthony Bly*, Sara Berg, and David Karki

INTRODUCTION

As grain commodity crop prices remain low, grain producers need to reduce costs. Effective soil nutrient management is one area to improve crop breakeven price. Therefore, an on-farm research project was conducted to evaluate nutrient management concepts in Minnehaha County South Dakota during 2017.

SUMMARY

The N only treatment, with 100 lbs N/a, was the most profitable (Table 2). The university concept was only ($0.83) less profitable compared with the N only concept which indicates that optimal economic return was closer to the university concept than the N only. The maximum approach was very unprofitable and lost ($130.04)/a. A “What if” scenario was developed to be more in line with what corn producers are using. The “What if” concept still lost ($68.65)/a. Following the university recommendations is recommended and can found in the Fertilizer Recommendations Guide (EC-750).

ACKNOWLEDGEMENTS

This project partially funded by SDSU Extension. A special thanks to Al Miron and Nate Strocheim for allowing the use of their corn field.

Table 1. Materials and Methods

Item	Description
Location	Near Crooks SD , Minnehaha County
Tillage	No-till
Fertilizer application method	Surface broadcast
Management Concept	N only, University, Maximum
N only concept nutrient rate	100 lbs N/a as surface broadcast UAN
University concept nutrient rate	160 and 15 lbs N and S/a as surface broadcast UAN, urea and AMS
Maximum concept nutrient rate	300 N, 80 P2O5, 300 K2O, 50 S and 10 Zinc lbs/a, surface broadcast UAN, urea, MAP, Potash, AMS and zinc sulfate.
Replications	4
Plot size	10 x 30 ft
Row spacing	30 inches
Statistics	RCBD, ANOVA with LSD

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Table 2. **Nutrient management strategy comparison for corn, Minnehaha County SD, 2017.**

Nutrient Strategy	Nutrient rates	Grain Yield	Fertilizer cost[A]	Net return to Nutrients[B]	Adjusted Gross for fertilizer[C]
	lbs/a N-P_2O_5-K_2O-S-Zn	bu/a	$/a	$/a	$/a
N only	100-0-0-0-0	159.2	38.00	na	439.48
University[D]	160-0-0-15-0	181.0	66.40	-0.83	438.65
Maximum[E]	300-80-300-25-10	192.9	232.20	-130.04	309.44
What if?[F]	160-40-60-20-2.5	192.9	104.30	-68.65	370.83

[A] N=$0.38, P_2O_5=$0.37, K_2O=$0.28, S=$0.376, Zn=$1.00 (base on December 2017 cost)

[B] Treatment yield difference with previous treatment x $3/bu corn – fertilizer cost.

[C] N only=yield x $3/bu – fert. price, University=N only adj gross + university net return, Max= N only adj gross + max net return.

[D] University recommendations based on EC-750 and 175 bu/a yield goal.

[E] Non-limiting N, crop removal P and build, base cation approach K, high S and Zn.

[F] University N, crop removal P, build soil K, insurance S and Zn.

Soil test results: Organic Matter = 4.1%, 36 lbs nitrate-N (0-2ft depth), Olsen P = 22.5 ppm (VH), soil test K = 164, pH = 6.2, SO4-S = 22.4 lbs/a, Zn = 2.92 ppm (VH)

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Nitrogen Timing for Corn Near Crooks SD, Minnehaha County, in 2017.

Anthony Bly*, Sara Berg, and David Karki

INTRODUCTION

The 4 R's of nutrient management supported by the International Plant Nutrition Institute (IPNI) include fertilizer nutrient management following the objectives of the right source, at the right rate, at the right place and at the right time. This study investigates both the Nitrogen (N) rate and timing of urea.

SUMMARY

N application rate was statistically significant at the 90% confidence level because the Pr>F statistic was less than 0.10 (Table 1). Maximum yield was attained near the 140 lbs N/a rate (Table 2 and Figure 1). Nitrogen timing was not significantly different, however the top-dress V6 application had numerically higher yields with the 20 and 40 lbs N/a application rates. The 20 and 40 lbs N/a rates applied at the V6 growth stage were 3.8 and 5.5 bu/a higher when compared with the similar rate applied at planting. The data from this research project does not conclusively provide substantial information supporting later application of N for corn.

ACKNOWLEDGEMENTS

This project partially funded by SDSU Extension. A special thank you to Nate Strocheim and Al Miron for allowing us to do this study on their farm.

Table 1. Materials and Methods

Item	Description
Timing N source	Urea
Planting N rates	0, 20, 40, 60 lbs N/a
V6 application N rates	0, 20, 40, 60 lbs N/a
Base N rate and source applied to all plots at planting	100 lbs N/a as surface broadcast UAN
Row spacing	30 inches
Crop rotation	Corn/soybeans
Tillage method	No-till
Plot size	5 x 25 ft
Replications	4
Statistics	RCBD, ANOVA

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Table 2. Urea Timing, No-Till Corn, Crooks SD, 2017

Planting		Top-dress V6[A]	
N rate[B]	Grain Yield		N rate[B]
lbs/a	----------- bu/a ----------		lbs/a
100	152.8 b	151.5 b	0
120	162.9 ab	166.7 ab	20
140	174.0 a	179.5 a	40
160	174.3 a	174.1 a	60

[A] All V6 plots received 100 lbs N/a at planting

[B] urea surface broadcast, no inhibitor, 20 year no-till

Stats: Pr>F (Timing)=0.42, (N rate)=0.08

Soil test nitrate-N = 36 lbs/a, Olsen P = 23 ppm, K = 164, OM = 4.1%, pH = 6.2, Zn=2.92 ppm, SO4-S=27 lbs/a

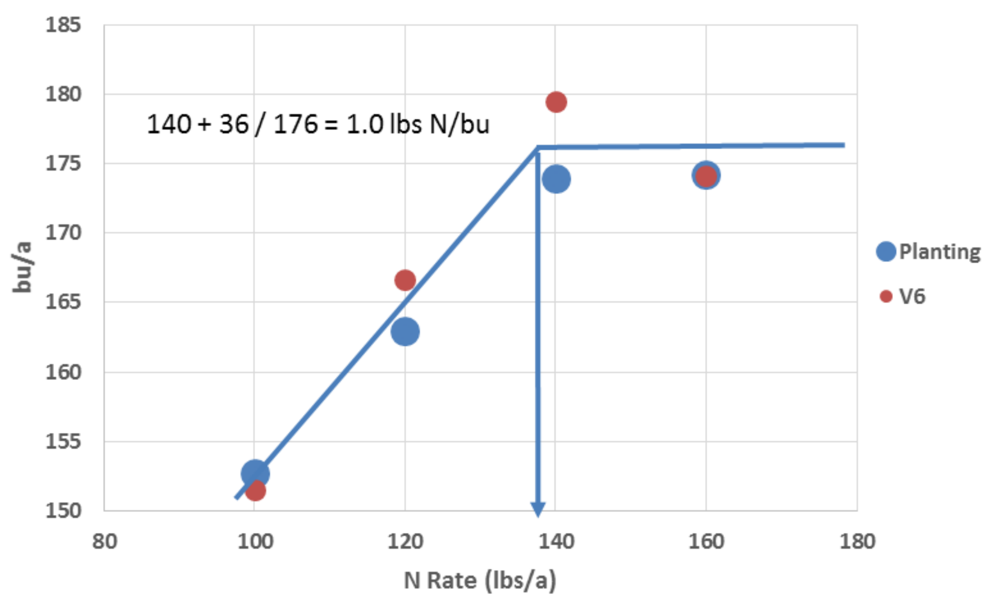

Figure 1. Urea N Rate timing near Crooks SD, Minnehaha County in 2017.

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Investigation of Soybean Seed Treatment and Inoculant in Southeastern, SD, 2017

Sara Berg*, David Karki,
and Anthony Bly

Soybean seed treatment products are widely utilized by many farmers in southeastern South Dakota and the surrounding area. These products often consist of an insecticide/fungicide combination, and/or inoculant that is mixed and placed on the seed as a pre-treatment before the grower plants the crop. Many insecticide/fungicide combination seed treatment products are marketed and developed to protect seeds and seedling plants from insects and plant diseases that may damage the seed or suppress/kill the seedling. In addition, inoculant is designed to enhance soybean performance using rhizobia by adding beneficial bacteria to the soil. The effects of inoculant are often most prevalent in soybean crops that have not had soybean in the rotation for several years. Although these products have become commonplace, understanding the positive effects of soybean seed treatments and inoculant is not commonly measured. Therefore, a study was developed near Tyndall, SD to measure soybean stand and yield performance where various seed treatments were placed in an on-farm trial in a randomized complete block design.

Table 1. Materials and Methods

Item	Description
Previous crop/tillage	Corn/Conventional tillage
Begin soil test	4.4% OM, 14lbs/a (0-2’) NO_3-N, 14ppm P (0-6”), 190ppm K, 6.6pH
After-harvest soil test	3.7%OM, 36lb/a (0-2’) NO_3-N, 6ppm P (0-6”), 157ppm K, 6.4pH
Plot size	12.6’ x 400’ = 0.116 acres
Variety	Hoegemeyer 2250NRR- RJS22005 (untreated)
Maturity Group	2.2
Seeding Rate	160,000 seeds/ac
Planting date	6/19/2016
Soil Fertility	P and K fertilized according to SDSU Soil Recommendations
Treatments	Table 2
Harvest Date	10/19/2017
Replications	3
Experimental design	Randomized Complete Block Design

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SUMMARY

With a wetter than average spring in southeastern SD, this plot was planted into suitable, but wet soils. However, the end of June and July proved to be dry, and excess moisture from early summer helped to keep crops growing during that dry period. This field was hit with large hail June 29, 2017, and again on August 21, 2017; hail damage in combination with dry growing conditions throughout June, July, and early August lowered crop yields overall.

There were slight yield variances between treatments, but there was no significant differences, meaning seed treatments did not significantly boost yields at this site (Table 2). Plant stand was also non-significant by treatment, but replications did have significantly different plant stands, which may be attributed to low areas within treatment strips that were accentuated due to the early, wet conditions.

Seed treatments did not significantly affect yield or plant stand in this trial. This treatment would cost approximately $13/unit (140,000 seeds) if treated by the seed dealer- in this study site and year, seed treatment and inoculant was not economical for crop production.

ACKNOWLEDGMENTS

This project partially funded by the South Dakota Soybean Research and Promotion Council and SDSU Extension. We would like to thank the cooperator for providing the field and planting the treatments for us.

Table 2. Stand and Yield of Soybean Seed Treatment Trial near Tyndall, SD, 2017.

Treatment[1]	Treatment application rate oz/140,000 seeds	Plant Stand plants/ac	Yield @ 13% bu/ac
Inoculant only[2]	1	52272	33.3
Seed Treatment only[3]	2.5	54565	36.8
Inoculant + Seed Treatment[4]	1 + 2.5	58233	38.3
Control	--	48604	32.5
CV		7.82	9.28
Pr>F		NS	NS

[1]Seed batch treated using small cement mixer.
[2]PPST 2030 + FST/IST and PPST 12+ on-seed inoculant plus extender product by Pioneer Biological.
[3]Gaucho®-XT flowable insecticide/fungicide seed treatment by Bayer; Allegiance® FL seed treatment fungicide by Bayer; and EverGol™ seed treatment fungicide by Bayer.
[4]Previously listed inoculant and seed treatment products combined and applied at full rate.

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Instinct HL, Agrotain Ultra, and Nitrogen Management Effect on Wheat Cereal Grain Yield

Sara Berg*, Anthony Bly,
and David Karki

Nitrogen (N) additives to control N losses through volatilization, denitrification, and leaching are widely used in the Midwest. Slowing the conversion of nitrogen fertilizers to nitrate may lessen leaching and denitrification losses if precipitation or soil becomes saturated. Urease inhibitors like Agrotain Ultra slow the conversion of urea to ammonia, lessening potential volatilization losses. Nitrification inhibitors like Instinct HL are designed to slow the activity of Nitrosomonas bacteria, which convert ammonium to nitrites; this may reduce the risk of N losses due to leaching and denitrification. Long term yield and economic response to these additives is highly dependent on the amount and timing of precipitation events. Therefore, a wheat nitrogen management study was conducted to evaluate the influence of Instinct HL (nitrapyrin- nitrification inhibitor) and Agrotain Ultra (N-(n-butyl)-thiophosphoric triamide(NBPT)- urease inhibitor/volatilization reducer) on wheat grain yield.

SUMMARY

The 2017 growing season brought temperate weather with a wet spring followed by less than average rainfall through June and July, followed by above average rainfall in the late summer at the Southeast (SE) Research Farm. Across three studies carried out at the SE Research Farm (i.e. spring wheat with urea, winter wheat with urea, and winter wheat with UAN), yield was significantly affected by nitrogen application rate and/or timing.

The spring wheat trial had significantly higher yields when nitrogen treatments were top dressed at 70% of the recommended N rate in the spring, rather than top dressed at 70% in the fall prior to soil freeze up. Control treatments had significantly lower yields compared with treatments where nitrogen fertilizer was applied. There were no significant differences between treatments applied with and without Instinct HL of the same N application rate.

The winter wheat trial with nitrogen applied as urea had significant differences between the control treatments and fertilized treatments, as one would suspect. There were also significantly lower yields where only 70% of recommended nitrogen fertilizer was applied. In addition, there were significant grain protein differences as plots fertilized at 70% of the recommended nitrogen rate had significantly lower protein than those fertilized at 100% in the fall or 50% in the fall and 50% top-dressed in the spring. When both Instinct HL and Agrotain Ultra were applied with urea fertilized at 100% of the recommended rate in the fall, grain protein was significantly higher than all other treatments. The control had significantly lower grain protein when compared will all other fertilized treatments.

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The winter wheat trial with nitrogen applied as UAN gave significantly higher yields where nitrogen was applied as a split application (treatment 7) with Instinct HL, as compared to split application where Agrotain Ultra was applied in place of Instinct HL (treatment 9). Yields in the control treatment were significantly lower than yields were nitrogen fertilizer was applied.

Nitrogen rate and timing effects on wheat yields are heavily dependent upon environmental conditions as well as plant development and nitrogen needs. Nitrapyrin and urease inhibitor treatments did not clearly effect wheat yields across studies in this site-year.

ACKNOWLEDGMENTS

This study was funded in part by Dow AgroSciences, South Dakota State University Extension, and the SDSU Southeast Research Farm.

Table 1. Materials and Methods

Item	Description
Previous crop/tillage	Oat/No-till
Begin nitrate-N soil test (0-2ft depth)	SW[1]: 30 lbs/a 0-2'; WW: 30 lbs/a N 0-2'
Plot size	SW: 20'x200'; WW Urea[2]: 20'x200'; WW UAN[3]: 15'x200'
Variety	SW: Prevail; WW: Sy-Wolf
Seeding Rate	SW: 110#/a; WW: 120#/a
Planting date	SW: 4/10/17; WW: 9/21/16
Treatments	Tables 2, 3, and 4
Nitrogen sources	SW: Urea; WW: Urea/UAN
Nitrogen application date Pre-plant	SW: 9/20/17; 4/6/17; WW Urea: 9/20/16; WW UAN: 9/20/16
Side dress N application date	WW Urea: 4/5/17; WW UAN: 4/5/17
Side dress N application method	WW Urea: Gandy spreader; WW UAN: Stream bar application
Harvest Date	SW: 8/11/17; WW Urea: 7/28/17; WW UAN :7/27/17
Replications	3
Experimental design	Randomized Complete Block Design

[1] 'SW' refers to the spring wheat study of 2017.
[2] 'WW Urea' refers to the winter wheat with urea study of 2017.
[3] 'WW UAN' refers to the winter wheat with UAN study of 2017.

Table 2. Effects of Instinct HL with urea on spring wheat in 2017 at the SDSU Southeast Research Farm near Beresford, SD.

-------------------Treatment---------------------					Protein[5]	Test Wt.	Stand	Yield[5]
	-------N[1] (%)-------		Instinct HL (oz/a)[4]					8/11/17
	Pre-plant[2]	Top-dress[3]	Pre-plant	Top-dress	%	lb/bu	plants/ac	bu/ac
1	0				13.8	57.70	846309	31.67e
2	100				14.7	58.83	920983	43.57cd
3	100		24		15.1	58.03	821417	47.20abc
4	70				14.6	58.90	1020549	43.70bcd
5	70		24		14.6	58.07	945874	41.49d
6		100			14.6	58.43	821417	48.91abc
7		100		24	14.9	58.20	970766	49.87a
8		70			14.0	58.60	883646	50.48a
9		70		24	13.8	59.13	871200	49.27ab
CV					3.64	1.22	8.99	7.22
Pr> F					NS	NS	NS	<.0001
LSD					--	--	--	5.64

[1]Percent of nitrogen fertilizer recommended according SDSU university recommendations EC-750.
[2]Pre-plant surface broadcast dry fertilizer application of 46-0-0 on 9/20/16.
[3]Top-dress surface broadcast dry fertilizer application of 46-0-0 on 4/6/17.
[4]Instinct HL is a nitrogen stabilizer product with nitrapyrin as active ingredient.
[5]Grain protein and yield adjusted to 13% moisture.

Table 3. Effects of Instinct HL and Agrotain Ultra with urea on winter wheat in 2017 at the SDSU Southeast Research Farm near Beresford, SD.

------------------Treatment------------------					Protein[6]	Test Wt.	Stand 1	Stand 2	Yield[5]
	------N[1] (%)------		Product Applied[4,5]						8/28/17
	Pre-plant[2]	Top-dress[3]	Pre-plant	Top-dress	%	lb/bu	plants/ac	plants/ac	bu/ac
1	0				9.70c	54.9	1082777	1161600.0	42.3c
2	100				10.6ab	56.2	1157451	1062034.3	70.2ab
3	100		I		10.6ab	54.7	1045440	1194788.6	67.7ab
4	100		I&A		10.9a	56.2	1107669	1078628.6	69.5ab
5	70				9.80c	56.2	1120114	1045440.0	60.6b
6	70		I		10.0c	55.2	1132560	1161600.0	60.3b
7	50	50			10.7ab	56.0	1082777	1095222.9	70.2ab
8	50	50	I		10.5ab	55.8	1132560	1078628.6	70.3ab
9	50	50		I	10.7ab	54.9	1107669	1227977.1	69.5ab
10	50	50	A		10.5b	56.6	1157451	1103520.0	70.5ab
11	50	50	I&A		10.5b	54.8	1095223	1078628.6	70.0ab
CV					2.32	2.34	--	9.58	4.91
Pr>F					<.0001	NS	--	NS	<.0001
LSD					0.41	--	--	--	5.48

[1]Percent of nitrogen fertilizer recommended according SDSU university recommendations EC-750.
[2]Pre-plant surface broadcast dry fertilizer application of 46-0-0 on 9/20/17.
[3]Top-dress surface broadcast dry fertilizer application of 46-0-0 on 4/5/17.
[4]Two products were applied with urea. ‘I’ is Instinct HL- applied at 24 oz/a; ‘A’ is Agrotain Ultra- applied at 3 qts/ton.
[5]Instinct HL is a nitrogen stabilizer product with nitrapyrin as an active ingredient; Agrotain Ultra is a urease inhibitor product with NBPT (N-(n-butyl)-thiophosphoric triamide).
[6]Grain protein and yield adjusted to 13% moisture.

Table 4. Effects of Instinct HL and Agrotain Ultra with UAN[1] on winter wheat in 2017 at the SDSU Southeast Research Farm near Beresford, SD.

	Treatment				Protein[7]	Test Wt.	Stand 1	Stand 2	Yield[7]
	------N[2] (%)-----		Product Applied[5,6]						8/27/17
	Pre-plant[3]	Top-dress[4]	Pre-plant	Top-dress	%	lb/bu	plants/ac	plants/ac	bu/ac
1	0				9.57	57.1	1057886	1028846	43.8c
2	100				9.73	57.5	1107669	1045440	61.8b
3	100		I		10.57	57.8	1145006	1028846	67.6ab
4	70				9.60	57.9	1145006	1037143	62.0b
5	70		I		9.50	56.8	970766	1136709	61.7b
6	50	50			9.90	57.3	1132560	1111817	66.2ab
7	50	50	I		10.10	56.8	1194789	1145006	74.0a
8	50	50		I	10.00	56.9	1045440	1169897	65.5ab
9	50	50	A		10.27	57.0	1207234	1086926	62.6b
10	50	50	I&A		10.27	57.2	1057886	1169897	68.0ab
CV					4.28	1.38	--	10.39	8.00
Pr>F					NS	NS	--	NS	.0002
LSD					--	--	--	--	8.69

[1]UAN is urea-ammonium nitrate or 28-0-0
[2]Percent of nitrogen fertilizer recommended according SDSU university recommendations EC-750.
[3]Pre-plant surface liquid fertilizer application of 28-0-0 (UAN) on 10/6/15.
[4]Top-dress surface liquid fertilizer application of 28-0-0 on 4/13/16.
[5]Two products were applied with UAN. ‘I’ is Instinct HL- applied at 37 oz/a; ‘A’ is Agrotain Ultra- applied at 1.5 qts/ton.
[6]Instinct HL is a nitrogen stabilizer product made with nitrapyrin; Agrotain Ultra is a urease inhibitor product made with NBPT (N-(n-butyl)-thiophosphoric triamide).
[7]Grain protein and yield adjusted to 13% moisture.

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Measuring Cover Crop and Nitrogen Rate and Application Timing effects on Corn Silage Yield near Crooks, SD, 2017

Sara Berg*, Anthony Bly,
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Many producers continuously chop corn silage for livestock feeding and/or feed sales in eastern and southeastern South Dakota, creating a monoculture pattern. Cutting corn silage removes nearly all plant materials from a field, leaving it bare, and lacking cover and substantial organic materials. In an effort to avoid soil erosion, increase nutrient cycling, and improve overall soil health, cover crop mixtures make an excellent alternative to fallow, bare soil following silage cuttings. In order to measure the effects of a cool season cover crop mixture planted immediately following corn silage, a trial was conducted near Crooks, South Dakota in 2017. This study was designed to measure the effects of different nitrogen fertilizer application rates and timings on silage yield, as well as the effect of cover crops on soil fertility and soil health.

Table 1. Materials and Methods

Item	Description
Previous crop/tillage	Corn silage/new no-till
Begin nitrate-N soil test 5/8/2017	No CC[1] 67lb/a (0-2'), 90lb/a (2-4'); CC[2] 82lb/a (0-2'), 56lb/a (2-4')
Plot size	15'x30'=0.01033ac
Cover Crop Mix Seeded/Seeding Rate	Oat/radish/turnip; 30lbs/a
Corn Variety/Seeding Rate	Croplan 4099/ 32,3000
Cover crop planting date	9/20/2016
Corn planting date	5/8/2017
Corn silage harvest date	8/28/2017
Treatments	Table 2
Nitrogen sources	SuperU® and Urea dry granular fertilizer
Nitrogen application date Pre-plant	5/24/2017
Side dress N application date	6/30/2017
Replications	4
Experimental design	Randomized Complete Block Design

[1] 'No CC' refers to treatments with no cover crops.
[2] 'CC' refers to treatments with cover crops.

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Table 2. Corn silage yield from a cover crop and nitrogen application rate/timing study near Crooks, SD, 2017.

N rate applied[1]	No CC[2]	CC[3]
lbs/ac	--------tons/ac at 37% DM[4]--------	
0	8.36	8.84
40	8.99	9.56
80	8.97	9.56
120	9.56	9.65
160	9.10	9.97
Pr>F	0.68-NS	0.57-NS
CV	12.42	9.97
40+40	8.51	9.13
80	8.97	9.56
Pr>F	0.38-NS	0.24-NS
CV	7.39	4.53
80u[5]	9.56	9.41
80	8.97	9.56
Pr>F	0.37-NS	0.77-NS
CV	8.64	6.95

[1]Nitrogen applied as SuperU® (or urea in the case of the '80u' treatment) fertilizer. SuperU® is a 46% nitrogen fertilizer product containing urease and nitrification inhibitors.
[2]'No CC' refers to treatments without cover crops.
[3]'CC' refers to treatments with cover crops.
[4]Silage cut on 8/28/2017 at an average of 36.98% moisture.
[5]'80u' represents 80 lbs/a of N fertilizer applied as urea.

Table 3. Soil test values following corn silage chopping from a study measuring cover crop and nitrogen application rate/timing effects on corn silage yield near Crooks, SD, 2017.

Treatment	Sample depth[4,5]	OM	NO_3-N
0N[1] No CC[2]	0-24"	2.4	10
	24-36"		4
0N CC[3]	0-24"	2.5	14
	24-36"		6
160N No CC	0-24"	2.8	53
	24-36"		13
160N CC	0-24"	2.7	85
	24-36"		18

[1]'0N' represents 0 nitrogen fertilizer applied.
[2]'No CC' represents no cover crop present.
[3]'CC' represents cover crop present.
[4]'160N' represents 160lbs/ac of nitrogen applied.
[5]Soil sampled following corn silage harvest 8/28/2017.

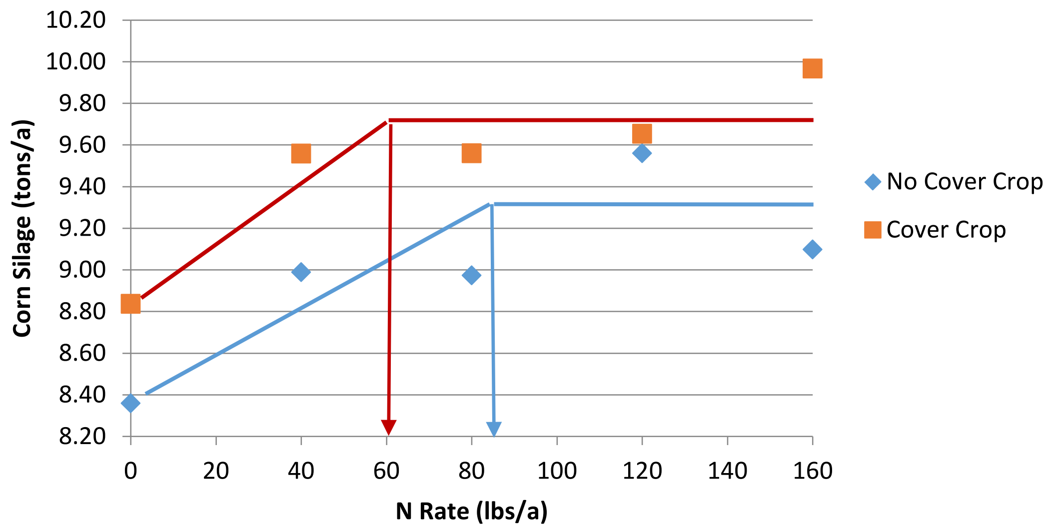

Figure 1. Corn silage yield and Nitrogen (N) rate from a study measuring cover crop and nitrogen application rate/timing effects on corn silage yield study near Crooks SD, 2017.

Contiguous corn silage rotations are prevalent on dairy farms across the Midwest. In this study, growing cover crops previous to corn silage had no significant impact on corn silage yield. In addition, nitrogen (N) rate and timing was studied. In this case, plots with cover crops planted prior to the corn silage crop, had less nitrogen fertilizer requirements than plots with no cover crop did. The optimum nitrogen rate for corn silage subsequent to a cover crop was approximately 60lbs/acre, whereas plots with no cover crop had an optimum nitrogen rate of approximately 85lbs/acre (Figure 1). This implies that this cover crop mixture lowered the optimum nitrogen application rate for this field. In addition to N rate treatments, a split N application was added to the trial. The split N application and N source comparison had no significant effect on yield (Table 2).

Cover crops provide a living root in the soil behind corn silage, where the ground would be traditionally fallow. By keeping the soil covered and adding a cool season broadleaf and grass mix to a warm season grass rotation, these cover crops added additional nutrient cycling, erosion control, biological diversity, and more. This trial reflects that cover crops planted prior to corn silage did not affect corn silage yield and decreased commercial fertilizer or manure application needs in this case.

ACKNOWLEDGEMENTS

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Soybean Seeding Rate x Row Spacing Interactions

Thandi Nleya* and Graig Reicks

METHODS

The soybean variety, Channel 2402, was either seeded in 30 in. wide rows with a planter or in 7.5 in. wide rows with a drill on June 12. The seed was untreated. Plots were seeded at either 75k, 105k, 135k, 170k, or 205k pure live seeds (PLS) ac^{-1}. The 90% germination value from the seed tag was used to calculate PLS. The 170k seeding rate/30 in. row treatment was excluded from the trial, as we suspect the wrong rate was planted.

RESULTS

Results from this site-year suggest that if one is looking to cut seeding rates, doing so with a drill may be advantageous over a planter, especially at a seeding rate of around 105k PLS ac^{-1} (Table 1). The 4.5 bu yield increase at 105k PLS ac^{-1} drilled in 7.5 in. rows over 135k PLS ac^{-1} planted in 30 in. rows was different at p=0.19 (not reported in table), which by many standards is considered marginally significant. Increasing seeding rates to 205k PLS ac^{-1} with a drill resulted in at least a 6.6 bu ac^{-1} yield difference over other treatments, which could be beneficial if economic returns exceed the cost of additional seed. It's important to note that soybean yield response to seeding rate and row spacing combinations are highly variable and that results from multiple site-years and your own on-farm testing should be taken into consideration when choosing an appropriate seeding method.

ACKNOWLEDGEMENT

Trial funded by South Dakota Soybean Research and Promotion Council

Table 1. The interaction between row spacing and seeding rate on soybean yields and plant populations near Beresford, SD in 2017

Row Spacing	Seeding Rate	Grain Yield	Final Population
---in.---	--PLS ac^{-1}--	---bu ac^{-1}---	---plants ac^{-1}---
7.5	205k	76.8 a†	182,081 a
7.5	135k	70.2 b	123,710 b
7.5	105k	69.8 b	104,544 c
7.5	75k	66.6 bc	83,635 d
30	205k	65.7 bc	177,870 a
30	135k	65.3 bc	120,153 b
30	75k	62.8 c	69,333 e
30	105k	61.5 c	92,928 cd
seeding rate x row spacing		p=0.42	p=0.52

†Values followed by different letters are significantly different at p<0.10.

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2017 Corn Foliar Fungicide Trials

Yabwalo[*], D., Geppert, R., and Byamukama, E.

INTRODUCTION

There are a few disease of corn that have potential to cause substantial yield losses and compromise grain quality. Common leaf diseases of corn in South Dakota include gray leaf spot (*Cercospora zeae maydis*), common rust (*Puccinia sorghi*), southern rust (*Puccinia polysora*), anthracnose (*Colletotrichum graminicola*) eyespot (*Aureobasidium zeae*) and northern corn leaf blight (*Exserohilum turcicum*) although there has not been a major corn disease scare in recent times.

Foliar diseases may increase crop susceptibility to stalk rots which may consequently trigger ear rot and lodging. The extent of disease severity is a direct result of management practices, presence of inoculum and favorable weather conditions for pathogen colonization and survival.

Fungicides are sometimes used to effectively manage corn foliar diseases. In South Dakota, however, corn foliar diseases occur less frequently and when they do, the severity levels are very low such that the use of foliar fungicides seem unnecessary. Nevertheless, continued research and monitoring of these diseases is important to keep generating data on the efficacy of fungicides, optimal application times and effective yet cost effective treatment combinations. Such information is critical as it can be applied in future disease epidemics. These studies, therefore, aimed at evaluating the efficacy of several fungicide products, applied at different growth stages to control fungal pathogens in corn.

MATERIALS AND METHODS

A Pioneer corn hybrid, 38N85, was planted to both the Foliar Fungicide and the Uniform Foliar Fungicide studies at 35,000 plants/acre at SDSU's research farms near Volga and Beresford, SD in two foliar studies named foliar fungicide I and II.

The trials were planted in randomized complete blocks (RCBD) with four blocks per location. Experimental plots were planted and harvested on dates shown in Table 1. Plants from the middle two rows were evaluated for foliar disease, greenness of tissue (2 weeks before combining), lodging, stalk rot and yield. Products for controlling foliar fungal diseases were applied at varying rates at V5, V4 – V7 and VT in both studies. All treatments were applied with a 0.125% v/v nonionic surfactant.

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RESULTS AND DISCUSSION

1.0 Foliar Fungicide Study (FF I) SERF & Volga

Although there were noticeable numerical differences in most of the traits assessed, the differences were not statistically significant. At SERF, untreated plots had a higher rust severity than the treated plots. However, disease severity was not high enough to cause yield differences (Table 2.1). The pattern was similar at Volga research farm (Table 2.2).

2.0 Foliar Fungicide Study (FF II) SERF & Volga

This trial was set up to assess various fungicides in the management of corn foliar diseases. Observations showed no significant differences although yield was lower for untreated compared with the treated plots and higher rust severity than treated plots at Volga. Untreated plots had a higher eyespot severity than treated plots at SERF (Table 3). However, treatment effect was not significant at either location.

SUMMARY

Disease severity was not high enough to attribute any differences in yield to disease. In addition, no linear associations were observed between yield and disease severity at both locations in the two trials.

ACKNOWLEDGEMENT

These studies were supported in part by SDSU Agricultural Experiment Station and collaborative private industry corporations. Thanks also go to SERF and Volga staff.

Table 1. Dates for planting, plot evaluations, and harvest at study locations.

	Date of operation by location	
Operation	SE Research Farm	Volga Research Farm
Planting	6/2/2017	5/8/2017
Harvest	11/1/2017	10/23/2017

Table 2.1. Corn Foliar Fungicide I (FF I): The efficacy of different products for corn foliar disease management at Southeast research farm, SD.

Treatment	Rate Rate unit	Growth stage	Yield (bu/A)	Rust (%)	Lodging (%)	Stalkrot (%)
Untreated			164.36 a	2.23 a	0.33 a	6.13 a
STRATEGO YLD	2 fl oz/a	V4 - V7	166.48 a	1.63 a	0.17 a	3.38 a
Experimental 1	4 fl oz/a	V4 - V7	169.73 a	1.73 a	0.33 a	7.10 a
Experimental 2	8 fl oz/a	VT	154.66 a	1.10 a	0.00 a	2.78 a
STRATEGO YLD	4 fl oz/a	VT	165.29 a	1.23 a	0.17 a	4.55 a

Means followed by the same letter are not significantly different at p=0.05

Table 2.2. Corn Foliar Fungicide I (FF I): The efficacy of different products for corn foliar disease management at Volga research farm, SD.

Treatment	Rate Rate unit	Growth stage	Yield (bu/A)	Rust (%)	Lodging (%)	Stalkrot (%)
Untreated			219.38 a	2.45 a	4.17 a	11.31 a
STRATEGO YLD	2 fl oz/a	V4 - V7	216.19 a	1.98 a	8.33 a	12.34 a
Experimental 1	4 fl oz/a	V4 - V7	214.31 a	2.13 a	1.83 a	10.92 a
Experimental 2	8 fl oz/a	VT	219.10 a	1.82 a	4.33 a	7.34 a
STRATEGO YLD	4 fl oz/a	VT	223.60 a	1.40 a	3.33 a	7.20 a

Means followed by the same letter are not significantly different at p=0.05

Table 3. Corn Foliar Fungicide I (FF II): The efficacy of different products for corn foliar disease management at Volga and Southeast Research Farm, SD.

				Volga				Southeast			
Treatment	**Rate**	**Rate unit**	**Growth stage**	**Yield (bu/A)**		**Rust (%)**		**Yield (bu/A)**		**Eyespot (%)**	
Untreated				194.06	a	0.50	a	159.68	a	3.80	a
Trivapro	13.7	fl oz/a	V5	204.11	a	0.00	b	152.79	a	2.25	ab
Quilt Xcel	10.5	fl oz/a	V5	204.25	a	0.00	b	172.74	a	2.55	ab
Headline Amp	10	fl oz/a	V5	221.77	a	0.03	b	168.17	a	2.50	ab
Stratego YLD	2.5	fl oz/a	V5	222.01	a	0.03	b	161.09	a	1.85	ab
Priaxor	4	fl oz/a	V5	208.26	a	0.00	b	161.78	a	1.90	ab
Fortix	4	fl oz/a	V5	187.83	a	0.00	b	174.84	a	2.05	ab
Folicur 3.6 F	5	fl oz/a	VT	215.61	a	0.00	b	175.54	a	1.35	b
Tilt	4	fl oz/a	VT	200.73	a	0.00	b	169.98	a	1.00	b

Means followed by the same letter are not significantly different at p=0.05

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2017 Soybean Foliar Fungicide and Cyst NematodeTrials

Yabwalo*, D., Geppert, R., and Byamukama, E.

INTRODUCTION

Most of the soybean foliar diseases prevalent in South Dakota are caused by fungal pathogens which rarely cause major economic concern. The most common diseases that occasionally occur in soybean fields include; Septoria leaf spot or brown spot (*Septoria glycines*), Cercospora blight and purple seed stain (*Cercospora kikuchii*), Frogeye leaf spot (*Cercospora sojina*) and Downy mildew (*Peronospora manshurica*) and White mold (*Sclerotinia sclerotiorum*) which is becoming a disease of interest due to its increasing prevalence in some parts of the state.

Soybean foliar diseases thrive under dense canopies, especially in wet and humid conditions. Brown spot overwinters in crop residues and is spread by splashing raindrops from infected residue to growing soybean leaves. However, brown spot rarely causes significant yield losses. Wet conditions with temperature range of about 68 to 78 °F are ideal for White mold. Unlike brown spot, white mold can cause yield losses of up 50% and affect seed quality.

Another soybean disease of interest is the soybean cyst nematode (SCN) which is caused by *Heterodera glycines*. It is one of the most damaging diseases of soybean in the US. The soybean cyst nematode is a microscopic soil worm that can proliferate relatively quickly such that by the time the population density is sufficient to cause above ground symptoms on crops, significant yield losses are already occurring. In addition, it is not easy to bring the SCN population down once the density is high. Effective SCN management involves monitoring SCN soil population and adopting agronomical practices that prevent population growth such as rotation and planting SCN resistant cultivars. The purpose of the studies implemented in the 2017 season was to evaluate the efficacy of new and potential fungicides/nematicides for foliar disease and SCN management, respectively.

MATERIALS AND METHODS

Two cultivars; S22-S1 (resistant) and S24-K2 (susceptible) were used in the SCN II experiment while P19T78R, a Pioneer release, was used in the foliar fungicide evaluation studies. GLXM02 was used for the SCN I study. Plots were randomized in complete blocks (RCBD) with four replicates per location for foliar fungicides while a split-plot arrangement in RCBD was used for SCN studies.

Plots were planted at 150,000 seeds/acre at the Southeast Research Farm (SERF) near Beresford, SD, at Hurley and at Volga Research Farm. Initial population counts were done at V5 while late population counts were collected at physiological maturity (R8). Foliar disease assessment were done at R5. Spring and fall SCN counts were also collected accordingly while yield, test weight and protein and oil content were determined at the harvest. Collected data was analyzed using a generalized

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linear mixed model (Proc GLIMMIX, SAS 9.4) where treatments were fixed and reps/blocks were random. Multiple comparisons of treatment means (LS-means) were generated using adjust = simulate approach, $\alpha = 0.05$. Table 1 shows operation dates for all soybean studies.

Table 1. Dates for planting, plot evaluations, and harvest at various locations.

Activity	Date of activity by location			
	SE Research Farm	Volga Research Farm	Hurley	Brookings
Planting:				
Foliar Fungicide	6/1/2017	6/1/2017	______	______
White mold I	_______	5/25/2017	______	______
White mold II	_______	5/26/2017	______	______
SCN I	6/1/2017	_______	6/1/2017	
SCN II	6/1/2017	_______	______	5/31/2017
Final disease rating:				
Foliar Fungicide	10/20/2017	10/19/2017	______	______
Harvest:				
Foliar Fungicide	10/20/2017	10/19/2017	______	______
SCN Demo I+II	10/19/2017		10/17/2017	10/18/2017

RESULTS AND DISCUSSION

1.0 Foliar Fungicide Trial SERF & Volga

This study was conducted to determine the efficacy of various foliar fungicides to manage different foliar disease caused by fungi in soybean. As is the case in every season, the 2017 season was no different in the sense that there was low disease prevalence both at Volga and SERF locations.

No significant differences were observed at either SERF or Volga which was expected since disease incidence and severity were low (Tables 1.1 and 1.2). In addition, a Pearson's Correlation analyses did not produce significant associations between yield and any of the diseases at both locations. However, green seeker readings (measure of greenness where the greener the plant the higher the score) at Volga showed high association with brown spot (r = -0.76, p<.0001) and weaker association with yield (r = -0.39, p=0.0028).

Table 1.1. Foliar Fungicide Study: Means for yield, test weight, brown spot, cercospora leaf spot and frog eye following application of fungicides at R3 at SERF, SD for the 2017 season.

Treatment	Rate	Rate unit	Yield† (bu/A)	Test weight (lb/bu)	Brown spot (%)	Cercospora Leaf spot (%)	Frogeye (%)
Untreated			78.59 a	56.98 a	0.00 a	0.23 c	0.10 a
Quadris	6.2	fl oz/a	84.57 a	56.96 a	0.00 a	0.50 bc	0.10 a
Tilt	4	fl oz/a	79.73 a	57.04 a	0.00 a	0.88 abb	0.05 a
Stratego YLD	4	fl oz/a	83.23 a	56.95 a	0.01 a	1.40 abc	0.05 a
Monsoon	3	fl oz/a	80.66 a	57.02 a	0.00 a	1.48 abc	0.00 a
Priaxor	8	fl oz/a	73.94 a	57.25 a	0.00 a	0.93 abc	0.10 a
Fortix	4	fl oz/a	78.81 a	57.28 a	0.00 a	1.00 abc	0.03 a
Aproach prima	5	fl oz/a	76.34 a	57.00 a	0.00 a	0.80 abc	0.45 a
Bravo Weather Stik	1.5	fl oz/a	76.94 a	57.47 a	0.00 a	1.88 ab	0.05 a
Sonata	1	qt/a	75.87 a	57.20 a	0.01 a	1.03 abc	0.08 a
Cuproxat	3.9	pt/a	79.31 a	57.20 a	0.00 a	2.08 a	0.08 a
Domark 230 ME	4	fl oz/a	80.21 a	57.31 a	0.00 a	1.83 ab	0.08 a
Trivapro (A 4.1 fl oz/A + B 10.5 fl oz/A)	20.7	fl oz/a	80.04 a	57.36 a	0.00 a	1.85 ab	0.23 a
Zolera FX 3.34 SC	5	fl oz/a	79.71 a	57.29 a	0.00 a	0.95 abc	0.18 a

†Means followed by the same letter are not significantly different, α=0.05

Table 1.2. Foliar Fungicide Study: Means for yield, test weight, brown spot, cercospora leaf spot and frog eye following application of fungicides at R3 at Volga, SD for the 2017 season.

Treatment	**Rate**	**Rate unit**	**Yield† (bu/A)**	**Test weight (lb/bu)**	**Brown spot (%)**	**Green seeker (0 - 0.9)**
Untreated			52.55 a	56.21 a	5.18 a	0.7465 a
Quadris	6.2	fl oz/a	47.94 a	56.61 a	2.15 a	0.8033 a
Tilt	4	fl oz/a	56.49 a	55.84 a	2.95 a	0.7715 a
Stratego YLD	4	fl oz/a	63.55 a	55.85 a	3.45 a	0.7580 a
Monsoon	3	fl oz/a	48.06 a	56.60 a	1.25 a	0.7833 a
Priaxor	8	fl oz/a	54.25 a	56.47 a	1.73 a	0.8103 a
Fortix	4	fl oz/a	57.62 a	56.21 a	3.88 a	0.7745 a
Aproach prima	5	fl oz/a	57.79 a	56.13 a	2.20 a	0.7800 a
Bravo Weather Stik	1.5	fl oz/a	52.85 a	56.46 a	2.50 a	0.7990 a
Sonata	1	qt/a	49.20 a	56.25 a	3.60 a	0.7453 a
Cuproxat	3.9	pt/a	48.84 a	56.54 a	3.48 a	0.7888 a
Domark 230 ME	4	fl oz/a	56.23 a	56.03 a	4.70 a	0.6995 a
Trivapro (A 4.1 fl oz/A + B 10.5 fl oz/A)	20.7	fl oz/a	46.89 a	55.41 a	3.83 a	0.7670 a
Zolera FX 3.34 SC	5	fl oz/a	54.33 a	56.16 a	3.93 a	0.7305 a

†Means followed by the same letter are not significantly different, α=0.05

2.0 Soybean Cyst Nematode Demonstration I — Hurley & SERF

Four treatments, nematicides, were used to assess their impact on SCN soil population and ability to prevent the negative effect of SCN on yield. At the beginning of the season, an initial SCN population was collected and was later used as a covariate in the final data analyses.

There were no significant differences on all traits that were assessed at both locations (Tables 2.1 and 2.2). A Pearson Correlation analyses for both locations yielded no significant associations.

Table 2.1. Soybean Cysts Nematode (SCN) I: Fall and spring SCN numbers, yield, early and final stand counts and test weight associated with various seed treatments at Hurley, SD for 2017.

Treatment	Yield† (bu/A)	Test weight (lb/bu)	Spring SCN numbers	Fall SCN numbers	First stand count	Second stand count
MAXIM 4FS						
APRON XL						
GAUCHO FS	62.38 a	56.93 a	83 a	383 a	103470 a	94394 a
INTEGO SUITE						
AVEO EZ	62.49 a	56.97 a	42 a	717 a	102018 a	86043 a
CRUISERMAXX VIBRANCE						
CLARIVA PN 15%	62.48 a	57.19 a	83 a	908 a	98024 a	94030 a
ACCELERON DX-109						
ACCELERON DX-309						
ACCELERON DX-612						
PONCHO VOTIVO -BACILLUS FIRMUS						
ISOLATE 1582	66.10 a	56.96 a	67 a	1592 a	106738 a	99839 a

†Means followed by the same letter are not significantly different, α=0.05

Table 2.2. Soybean Cysts Nematode (SCN) I: Fall and spring SCN numbers, yield, early and final stand counts and test weight associated with various seed treatments at SERF, SD for 2017.

Treatment	Yield (bu/A)	Test weight (lb/bu)	Spring SCN numbers	Fall SCN numbers	First stand count	Second stand count
MAXIM 4FS						
APRON XL		w				
GAUCHO FS	61.43 a	56.82 a	192 a	758 a	103470 a	93304 a
INTEGO SUITE						
AVEO EZ	62.96 a	56.52 a	233 a	1100 a	100203 a	99113 a
CRUISERMAXX VIBRANCE						
CLARIVA PN 15%	59.89 a	56.73 a	342 a	608 a	95846 a	91126 a
ACCELERON DX-109						
ACCELERON DX-309						
ACCELERON DX-612						
PONCHO VOTIVO -BACILLUS FIRMUS						
ISOLATE 1582	59.00 a	56.62 a	267 a	1142 a	100203 a	98387 a

†Means followed by the same letter are not significantly different, α=0.05.

This study also evaluated the efficacy of two relatively new nematicide products for controlling SCN on two cultivars, S22-S1 (resistant) and S24-K2 (susceptible). The study was maintained at a grower's farm near Brookings and at SERF.

There were no significant differences in yield at the Brookings location. However, untreated plots produced the lowest yield on average and the lowest final stand count; thus for the resistant cultivar. Similarly, untreated plots for the susceptible cultivar produced the lowest final stand count and the lowest yield although the differences were not statistically different (Table 3.1).

Within cultivar, no statistical differences were observed at SERF. Any other trait differences were not consistent enough to be attributable to treatment effect (Table 3.2).

Table 3.1. Soybean Cysts Nematode (SCN) II: Yield, test weight, spring and fall SCN counts, early and final stand counts associated with various seed treatments at Brookings location, SD for 2017.

Cultivar	**Treatment**	**Yield**† **(bu/A)**	**Test weight (lb/bu)**	**Spring SCN count**	**Fall SCN count**	**First stand count**	**Second stand count**
S22-S1	Untreated	48.01 a	56.90 a	1302 a	426 d	109381 a	123949 ed
S22-S1	Cruiser Maxx Beans + Vibrance @0.095 mg ai/seed	50.55 a	57.19 a	853 a	1187 cd	109485 a	180456 a
S22-S1	Avicta Complete Beans 500 + Vibrance @0.242 + 0.004 mg ai/seed	54.84 a	57.08 a	851 a	958 cd	109150 a	146059 bcd
S22-S1	Clariva + Complete Beans @0.095 + 0.205 mg ai/seed	49.46 a	56.83 a	2055 a	1594 bcd	s13384 a	s52701 bc
S22-S1	ILeVo @0.075 mg ai/seed	52.43 a	56.92 a	301 a	464 d	106811 a	147536 bcd
S24-K2	Untreated	39.56 a	56.85 a	1583 a	4692 abc	113790 a	112211 de
S24-K2	Cruiser Maxx Beans + Vibrance @0.095 mg ai/seed	53.54 a	57.21 a	948 a	5223 ab	108369 a	138372 bcde
S24-K2	Avicta Complete Beans 500 + Vibrance @0.242 + 0.004 mg ai/seed	51.53 a	57.27 a	1090 a	6261 a	118395 a	158260 ab
S24-K2	Clariva + Complete Beans @0.095 + 0.205 mg ai/seed	41.85 a	57.24 a	646 a	6758 a	110763 a	128402 cde
S24-K2	ILeVo @0.075 mg ai/seed	57.97 a	57.31 a	440 a	5354 ab	77869 a	131615 bcde

†Means followed by the same letter are not significantly different, α=0.05.

Table 3.2. Soybean Cysts Nematode (SCN) II: Yield, test weight, spring and fall SCN counts, early and final stand counts associated with various seed treatments at SERF, SD for 2017.

Cultivar	Treatment	Yield (bu/A)	Test weight (lb/bu)	Spring SCN count	Fall SCN count	First Stand count	Second Stand countSC2
S22-S1	Untreated	59.02 a	55.94 ab	393 a	900 a	109460 a	93423 b
S22-S1	Cruiser Maxx Beans + Vibrance @0.095 mg ai/seed	61.34 a	56.14 ab	427 a	700 a	113817 a	99445 ab
S22-S1	Avicta Complete Beans 500 + Vibrance @0.242 + 0.004 mg ai/seed	58.97 a	55.63 b	375 a	900 a	113272 a	116410 a
S22-S1	Clariva + Complete Beans @0.095 + 0.205 mg ai/seed	69.30 a	56.31 ab	375 a	1000 a	110550 a	106816 ab
S22-S1	ILeVo @0.075 mg ai/seed	59.29 a	56.66 ab	361 a	450 a	101836 a	102873 ab
S24-K2	Untreated	57.79 a	56.87 ab	361 a	2300 a	105648 a	111272 a
S24-K2	Cruiser Maxx Beans + Vibrance @0.095 mg ai/seed	52.86 a	56.92 ab	361 a	850 a	99658 a	110657 a
S24-K2	Avicta Complete Beans 500 + Vibrance @0.242 + 0.004 mg ai/seed	56.24 a	57.20 a	214 a	1100 a	99658 a	113627 a
S24-K2	Clariva + Complete Beans @0.095 + 0.205 mg ai/seed	56.22 a	56.81 ab	427 a	1400 a	108371 a	101565 ab
S24-K2	ILeVo @0.075 mg ai/seed	60.68 a	56.97 ab	352 a	1200 a	87677 a	104312 ab

[†]Means followed by the same letter are not significantly different, α=0.05.

SUMMARY

As mentioned earlier, disease prevalence was not high enough to produce treatment differences in the foliar fungicide study. As for SCN, there were no significant correlations between SCN numbers and yield nor final population. However, the increase in SCN population was lower in the resistant cultivar than it was in the susceptible cultivar suggesting that a resistant cultivar suppresses SCN population increase in the soil. Therefore, the importance of monitoring SCN and planting an SCN resistant cultivar cannot be overemphasized.

ACKNOWLEDGEMENT

Financial and material support for these research studies came from the SD Soybean Research and Promotion Council, SDSU Agricultural Experiment Station and various private industry corporations. Furthermore, we appreciate the collaborative efforts from Southeast Research Farm staff as well as Volga farm staff.

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Soil Biophysics and Hydrology Lab Project Report from Southeast Research Farm Plots

Sandeep Kumar* (PI), Liming Lai, Research Associate, Jasdeep Singh MS, Atilla Polat, MS

Project 1: (Long-term Rotation and Tillage Plots/ Field 302)

Title. Investigating the Impacts of Crop Diversification and Cover Crops Under Different Tillage Systems on Soil Health.

Project personnel: Sandeep Kumar (PI), Jasdeep Singh (MS candidate)

Summary. The experimental site is located at the SDSU Southeast Research Farm located at Beresford, South Dakota. The experiment was initiated in 1991 to assess the impact of different tillage systems and crop rotations on the long term production and economics of cropping systems. The experimental site has 80 plots distributed randomly in a complete block design. Each plot has a width of 20 m and a length of 100 m. The experimental plots were designed to be large so that field operations could be carried out using commercial sized farm equipment. The experiment had three different tillage systems which were no till (NT), conventional till (CT), and strip till (ST). ST system had only a two-year crop rotation; corn (*Zea mays* L.) – soybean (*Glycine max*. L.). In the fall of every year after harvest, residues of corn and soybean were disked and chiseled in all of the conventionally tilled plots. The ST plots were excluded from this study because it had only one rotation system. Both NT and CT had three rotation systems, which were a two-year rotation of corn-soybean, a three-year rotation of corn-soybean-wheat (*Triticum aestivum* L.), and a four-year rotation of corn-soybean-wheat-oat (*Avena sativa*). In our study, we are also interested in Cover Crop (CC) treatments. In fall of 2013 CC treatments were introduced to plots with each plot split into CC and no cover crop (NC). Winter rye is sown after corn harvest and blends of legumes and brassica spp. after small grains harvest in every rotation. Spraying is done before soybean planting to kill winter rye, and frost killed blends.

Measurement of Soil Organic Carbon (SOC) and nutrients. Soil samples were collected in fall after harvesting the corn. Soil samples were collected from four depths (0-7.5 cm, 7.5-15 cm, 15-30 cm and 30-60 cm) using a Tractor Mounted Hydraulic Push Probe having a diameter of 3 cm. Samples were mixed together in the field to make a composite sample. Composited soil samples were labeled, sealed in plastic zip-lock bags, and transported to the laboratory. After bringing the soil samples to the laboratory, all of them were air dried, ground, and sieved to pass a 2-mm sieve. All of the analyses were carried out using the fine soil fraction (< 2 mm in diameter). Soil organic carbon (SOC) was measured using the Dry Combustion Method. P was extracted using a 0.5 *M* $NaHCO_3$ solution, and then the extraction was measured calorimetrically (Olsen, 1954). Nitrate was determined using a nitrate-specific ion electrode. Available K was extracted by 1 M NH_4OAc at pH 7.0, and it was determined using an atomic absorption (AA) (Warncke and Brown, 1998).

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Measurements of Soil Biochemical Parameters. Effect of Rotations, Cover Crops and Tillage on Soil Biochemical Indicators of Soil Health. (Chapter #1 of MS thesis, J. Singh). The soil samples were taken three times during corn phase in 2017. In each plot, the soil was replicated at least four times at surface depth (0-7.5 cm) using a manual soil probe. After removing easily identified plant materials, i.e., stalks and leaves, a composite sample was prepared for laboratory analysis. Soil samples were kept fresh and stored in sealed plastic bags at 4°C until use. In the laboratory, microbial biomass carbon (MBC) and nitrogen (MBN) were analyzed by chloroform fumigation and direct extraction with K2SO4. MBC and MBN were calculated as the difference between the amounts of C and N measured in fumigated and the non-fumigated soils. The water extractable organic carbon (WEOC) and acid hydrolysis were carried out by the schematic procedure described by Ghani et al. (2003) and Silveira et al. (2008). The extraction was done with distilled water in a soil-to-solution ratio of 1:10. A 3 g of soil was poured with 30 ml of water and put for shaking on vortex and rotatory shaker for 10 sec. and 30 min. at 40 rpm respectively. After extraction, the suspension was centrifuged at 3000 rpm for 25 min. at 4°C. The filtrate obtained is cold water extractable organic carbon (CWEC). A further 30 ml of water is added to the remaining residue and put on a vortex shaker for 10 sec. The suspension was left in hot-water bath at 80°C for 12-15 h. After extraction, the suspension was again put on vortex shaker for 10 sec and then, centrifuged at 3000 rpm for 25 min. at 25°C. The filtrate obtained is hot water extractable organic carbon (HWEC). After CWEC and HWEC, the same soil sample was air-dried and at first used for carrying out acid hydrolysis with 1M HCl and then, with 6M HCl at 105°C for 6 h in a soil-to-solution ratios of 1:30. Both hydrolysis were centrifuged separately at 3000 rpm for 25 min. and the supernatant's obtained are termed as 1M and 6M acid extractable carbon fractions. Urease activity was determined by the buffer method proposed by Kandeler and Gerber (1988) where ammonium (NH_4-N) released was estimated colorimetrically at 660 nm after a 2-hour incubation of soils. Urease activity was expressed as µg NH_4-N g^{-1} dry soil 2 h^{-1}. β-D-glucosidase activity was assayed according to Eivazi and Tabatabai (1988), using the substrate analogue para-nitrophenyl-β-D-glucopyranoside (pNPG) and adsorption of released para-nitrophenol (pNP) at 405 nm in field-moist soil samples. β- Glucosidase activity was expressed as µmol pNP released g^{-1} dry soil h^{-1}.

Measuring Hydrological Properties. Influence of long-term soil management and crop rotation systems with and without cover crops on hydrological and physical properties of soil. Parameters performed were Water infiltration (WI), field capacity (FC), soil penetration resistance (SPR), bulk density (BD), soil water retention (SWR), soil aggregation and pore size distribution (PSD). (Chapter #2 of MS thesis, J. Singh).

Soil samples were collected in Fall 2017 after harvesting corn. WI was performed only on NT plots with and without cover crops by double ring infiltrometer. For other parameters, two cores of soil samples from each plot were collected at a depth of 0-7.5 cm using a bulk density core sampler. These cores are used to calculate BD. SPR was performed by an Eijkelkamp-type hand penetrometer at 0-7.5 cm. Soil for the aggregate stability was sieved in the field < 2mm. Soil water retention (SWR) was analyzed by tension and pressure plated extractors method as explained in Klute and Dirksen (1986).

Measuring Green House Gas Emissions: The greenhouse gases were measured from plots with 2-yr and 4-yr rotation managed with NT. The CC treatments were also included. The objective was to understand greenhouse gas potential when CC residues incorporated into the soil. The samples were only collected from vegetation season of corn. This objective will be continued for more next couple of years to get a complete understanding of the CC system.

Moisture and Temperature dynamics: Our research group also measured the soil water and temperature dynamics during the growing season of corn. The plots selected are managed with NT and CC treatments. We installed the sensors at different depths up to 60 cm. Soil moisture, water retention rods, and temperature sensors were installed in PVC pipes protected with watchdogs. The objective of the study was to understand soil water improvements with use of cover crops in NT and corn/soybean and corn/soybean/oats/winter wheat rotation.

Project deliverables/products:

Poster presentation at ASA conference by a graduate student (Jasdeep Singh).
Singh J., S. Kumar and P. Sexton 2017. Impacts of Diverse Crop Rotations and Cover Crops Under Different Tillage Systems on Soil Health in South Dakota. Poster Presentation at the ASA-CSSA-SSSA. International Annual Meeting in Tampa, FL, October 22-25, 2017.

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Project 2: Long-term Crop-Livestock Plots / Field 204

Title. The Impact of Integrated Crop-Lıvestock System on Soil Quality Parameters in the South Dakota State
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Project personnel: Sandeep Kumar (PI), Atilla Polat (MS candidate)

Summary. The experimental site is located at the SDSU Southeast Research Farm located at Beresford, South Dakota. The experiment was initiated in 2016 to assess the impact of the integrated crop-livestock system on the long-term production and soil health. The experimental site has 40 plots distributed randomly in a complete block design. Each plot has a width of 60 and a length of 120 feet. The experimental plots were designed to be large so that field operations could be carried out using commercial sized farm equipment. The experiment had three different treatment systems which were plants (corn, soybean, oat), cover crop (cc), and grazing (g). We collected the soil samples in June of 2017. We are planning to collect soil samples the same date in 2018. In this project, we also will use the soil management assessment framework (SMAF) model to evaluate the soil quality.

Task: Soil properties assessment

Soil pH and electrical conductivity (EC)
Soil Nutrients (N, P, K, Na, Ca, Mg)
Microbial biomass carbon and nitrogen (MBC, MBN)
Soil water retention
Soil aggregate stability
Penetration resistance

****

Project 3: CAP project at Beresford in 2017

Title: Soil Properties and Soil Surface Greenhouse Gases in an Integrated Crop-Livestock System in South Dakota.

Project personnel: Sandeep Kumar, Peter Sexton, Liming Lai, Atilla Polat, and Jasdeep Singh.

Summary:
The objective of this study was to monitor soil GHG fluxes including carbon dioxides (CO_2), methane (CH_4), and nitrous oxide (N_2O) for evaluating impacts of ICLS on the environment. The experiment was a randomized complete block design with 4 replications at Beresford site in South Dakota. The treatments were (i) corn (*Zea mays* L.)-soybean (*Glycine max* L.)-rye (*Secale cereal* L.) (control), (ii) corn-soybean-rye/cover crops, and (iii) corn-soybean-rye/cover crops with grazing. GHGs were sampled using static chamber method at three-time intervals over 40 minutes (0, 20, 40 minutes). The sample collection was weekly conducted throughout the growing season (July through October) in 2017. The Gas Chromatography (GC) machine was used to measure concentrations of CO_2, CH_4, and N_2O, and then calculate the fluxes based on these concentrations. The preliminary results showed that the mean N_2O fluxes were significantly higher under the grazing treatments than for the ungrazed. The rotation and grazing

treatments did not have significant effects on the CO_2 and CH_4 fluxes.

Task 1: Soil properties assessment
Soil pH and electrical conductivity (EC)
Soil Nutrients (N, P, K, Na, Ca, Mg)
Microbial biomass carbon and nitrogen (MBC, MBN)
Soil water retention
Soil aggregate stability
Penetration resistance
Task 2: Soil surface greenhouse gas flux assessment
Carbon dioxide
Methane
Nitrous oxide

****

Project 4: FY18-NREC-Manure project 2018

Title: Impacts of Manure and Inorganic Fertilizer on Soil Fertility, Water Quality, and Crop Yield in South Dakota.

PI: Sandeep Kumar, **Collaborators**: Peter Kovacs, Jose Guzman.

Summary. This project will focus on comparing the soil fertility and crop yield as impacted by different manure and inorganic nitrogen (N) fertilizer rates under corn-soybean-spring wheat/cover crop rotation. Data collected from FY-2017 and FY-2018 will be compiled and used in developing the best fertilizer management practices using the Soil Management Assessment Framework (SMAF) tool to improve the soil fertility and crop yield. The study sites were established in 2003 and 2008 at Beresford and Brookings, SD, respectively. Spring wheat and cover crops were introduced at Beresford in 2017 and planned at Brookings for 2018.

Task: Develop site-specific best fertilizer management practices using SMAF tool

It is a soil quality assessment tool that integrates the biological, chemical, and physical indicator data collected from FY-2017 and FY-2018 to assess management effects on soil quality. It consists of three steps: (i) indicator selection, (ii) indicator interpretation (soil indicators will be scored by transforming measured values into 0-1 values), and (iii) integration into an overall soil quality index (by adding up the scores and dividing by the number of indicators) which is expressed as a percentage of full performance of soil functions.

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Evaluating the Effect of NPK Fertilizer on the Interaction Between Soybean Cyst Nematode and Fusarium Proliferatum in Beresford, SD 2017

Funded by South Dakota Soybean Research and Promotion Council.

P. Okello, S. Osborne, N. Braun, B. Kontz, K. Kirby, J. Kleinjan, and F. Mathew*

A field trial was conducted at the South Dakota State University Southeast Research Farm in Beresford, SD in 2017. Soybean seeds of two soybean varieties (Monsanto, St. Louis, MO) - 'AG2531 (RM 2.4)' (susceptible to SCN) and 'AG2336 (RM 2.3)' (resistant to SCN) – were planted on June 1, 2017 into a conventional-till field of silty clay loam soil previously cropped to corn.

The following herbicides were applied on July 3, 2017:- Flexstar 10 oz/a, Firstrate 0.3 oz/a and Select 4 oz/a. The experimental design was a randomized complete block with 4 replications per treatment. The experimental plots were planted as 4 rows, spaced 30 in. apart and 20 ft long with a four-row SRES Precision Planter at a rate of 165,000 seed/ac.

For inoculum, *Fusarium proliferatum* was grown for three weeks on autoclaved millet seeds in trays at 22^{o}C. After incubation, the colonized millet seeds were air dried and stored at 25^{o}C until use. The colonized seeds were spread on the plots using a fertilizer cart approximately seven days after planting. Fertilizers were spread with a fertilizer cart at the rate of 15: 15: 15 (N: P: K) for starter fertilizer treatment and 50: 80: 110 (N: P: K) for high levels of fertilizer treatment.

Stand counts were taken 14 days after planting (June 15) and 21 days after planting (June 21) when the soybean were in the vegetative growth stage VC-V1 (cotyledon and first trifoliate leaves) and V1-V2 (first and second trifoliate leaves) respectively as the total number of plants in the middle two rows of each plot. Additionally, soil was sampled after planting from each of the plots to get an initial assessment of SCN population. Plants in each plot were examined for symptoms of damping-off when stand counts were taken. Phytotoxicity, and vigor was evaluated on June 15 using the following scale, where: 0 = 0%, 2 = trace to 4%, 7 = 5 to 10 %, 15 = 11 to 20%, 30 = 21 to 40%, 50 = 41 to 60%, 70 = 61 to 80%, 85 = 81 to 90%, 93 = 91 to 95%, and 98 = 96 to 100%. At the time of stand counts, ten soybean plants were sampled from the outer two rows of each plot to rate for lesion length caused by fungal pathogen.

Roundup Power Max (32 oz/a) was applied on July 27, 2017 to the soybeans. On October 12, 2017 soil was sampled from each of the plots to get a final SCN count and also ten soybean plants were sampled from the outer two rows of each plot to rate for lesion length caused by *Fusarium proliferatum*. On October 18, 2017 the middle two rows of all plots were harvested.

Data was analyzed using R (v2.11.1; https://www.rstudio.com/). Treatment means were separated using LSD test ($P \leq 0.05$).

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Plant stands taken at 14 days after planting (DAP) were not significantly different ($P > 0.05$) among treatments. However, numerical differences were observed between either of the two N-P-K fertilizer applications and no fertilizer application inoculated plots with both SCN susceptible and resistant soybean varieties (Table 1).

As for lesion length caused by *Fusarium proliferatum* on soybean roots, it was not significantly different ($P > 0.05$) in both SCN-susceptible and resistant cultivars plots at vegetative growth stage VC-V1 (cotyledon and first trifoliate) growth stage. However, at reproductive stage R8 (full maturity), lesion length on the soybean roots caused by *Fusarium proliferatum* was significantly different ($P = 0.02$) with shorter lesions on SCN-resistant cultivars compared to SCN susceptible cultivars plots.

For SCN, the initial population densities (per 100 cc of soil) ranged from approximately 113 to 1238 eggs and juveniles/100 cc of soil in plots inoculated with *F. proliferatum* and 225 to 700 eggs and juveniles /100cc of soil in non-inoculated plots. At harvest, higher SCN population densities (>1500 SCN eggs/100 cc of soil) were observed in SCN susceptible plots compared to plots with SCN resistant soybean varieties (< 700 SCN eggs/100 cc of soil).

Yield (bu/a) was significantly different (*P* < 0.05) among treatments. The highest yields were observed in plots with SCN resistant soybean cultivars in combination with starter fertilizer treatment (Table 1).
This trial will be repeated in 2019.

<u>ACKNOWLEGEMENT</u>

We thank the SDSU Southeast Research Farm at Beresford for all the technical help in this project. We also thank the South Dakota Soybean Research and Promotion Council for funding.

Table 1. Analysis of Variance (ANOVA) to evaluate the effect of NPK fertilizer on the interaction between soybean cyst nematode and *Fusarium proliferatum* in Beresford, SD, 2017.

Variety	Pathogen	Fertilizer treatments	Lesion length (VC-V1)	Lesion length (R8)	Stand count (14 DAP)	SCN count (initial)	SCN count (final)	Yield (bu/A)
SCN Susceptible	SCN	N:P:K (0:0:0)	38.50	104.25	78190.20	337.50	2450.00	47.75
	SCN +*Fusarium Proliferatum*		34.75	116.00	88535.70	362.50	3337.50	54.75
	SCN	N:P:K (15:15:15)	29.63	118.50	64904.40	700.00	2725.00	52.08
	SCN +*Fusarium Proliferatum*		33.63	128.88	83417.40	250.00	2962.50	55.93
	SCN	N:P:K (50:80:110)	31.88	120.75	67082.40	225.00	1700.00	55.80
	SCN +*Fusarium Proliferatum*		30.63	109.88	73943.10	1237.50	3187.50	58.10
SCN Resistant	SCN	N:P:K (0:0:0)	35.88	90.50	78625.80	700.00	312.50	60.35
	SCN +*Fusarium Proliferatum*		35.63	115.75	89515.80	250.00	662.50	63.33
	SCN	N:P:K (15:15:15)	34.13	89.25	83526.30	387.50	400.00	66.83
	SCN +*Fusarium Proliferatum*		31.63	93.13	67953.60	437.50	575.00	62.00
	SCN	N:P:K (50:80:110)	35.38	89.75	85486.50	287.50	375.00	65.83
	SCN +*Fusarium Proliferatum*		31.88	94.75	75576.60	112.50	375.00	64.60
		P-value	> 0.05	0.02	> 0.05	> 0.05	0.001	0.01
		LSD	10.53	26.22	43534.59	1797.77	1603.61	9.85

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SDSU Oat Breeding

Melanie Caffe-Treml* and Nick Hall

Oat is a good crop choice to increase diversity in corn soybean rotations. It is a low input crop; it can break pest cycles and improve soil health. In South Dakota, oat is grown for both forage and grain. Oats are a good source of animal feed and can provide straw. Because of oat health benefits, there is also a growing market for its use by the food industry. The goal of the oat breeding program at SDSU is to develop new high yielding oat varieties that fit the different end-uses in order to increase the profitability of South Dakota producers.

The SDSU oat breeding program uses the Southeast Farm (SERF) as one of its multiple testing locations to ensure that new varieties developed by the breeding program are adapted to the broad range of environmental conditions encountered in the state. In 2017, close to 900 test plots were seeded at SERF. We evaluated materials at various stages of development, from early generations to advanced breeding lines. State and regional nurseries were also grown at SERF. Data collected on each entry included heading date, height, lodging, yield, and test weight. In addition, grain samples harvested at SERF were used to perform milling and nutritional quality evaluations. Data collected will be used to select lines with improved agronomic performance and improved milling and nutritional quality.

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Field evaluations at SERF as well as at other testing locations in the state over the last five years lead to the selection of experimental breeding line SD120296. Because of its excellent agronomic performance, SD120296 was released as ‘Saddle’ in Fall 2017. Saddle is an early maturing variety with high yield potential, good test weight, and excellent lodging resistance. Saddle demonstrates excellent disease resistance, it is resistant to smut and crown rust, and moderately resistant to barley yellow dwarf virus (BYDV). In addition, Saddle exhibits satisfactory milling quality.

Two additional breeding lines performed well in the South Dakota Crop Performance Testing Oat Variety Trial (CPT) and have the potential to be released in the next two years:

- Experimental line **SD120419** is an F_5-derived line from the cross SD041405/SD060130. It reaches heading about 1 day later than Horsepower. Plant height is about 1 inch taller than Horsepower and it demonstrates excellent lodging resistance. It was evaluated in the Uniform Mid-Season Oat Performance Nursery (UMOPN) and in the CPT in 2016 and 2017. SD120419 has high yield potential with test weight similar to Horsepower. It is resistant to smut and crown rust and moderately susceptible to BYDV. Groat percent and percent plump, mid, and thin kernels for SD120419 are similar to Shelby 427. Protein, beta-glucan and fat contents are average.

- Experimental line **SD120665** is an F_5-derived from the cross SD061081/SD071195. It is a line with mid-to-late maturity, heading about 1 day later than Horsepower. Plant height is about 2 inches taller than Horsepower with average lodging resistance. It was evaluated in the UMOPN and CPT in 2016 and 2017. It exhibited high yield potential and excellent test weight. It is resistant to smut, moderately tolerant to BYDV, and moderately resistant to crown rust. Groat percent for SD120665 is low; however, SD120665 has a large proportion of plump kernels and very low thins. Protein, beta-glucan, and fat contents are lower than average.

SDSU advanced breeding lines were evaluated in the regional nurseries along with breeding lines from other regional oat breeding programs. Table 1 presents their performance in the UEOPN.

SDSU experimental breeding lines SD141130, SD141070, and SD140515 exhibited high yield potential and excellent test weight. SD141070 is a F_5-derived line with the pedigree SD081629//Shelby 427/ND051306. It demonstrated good lodging resistance. SD141130 and SD140515 are two lines with the pedigree SD080015//SD070110/SD060130. Both SD141130 and SD140515 have good level of resistance to crown rust.

Winter crops present several advantages over spring planted crop including reduced soil erosion, improve water use efficiency, and better ability to compete with weed. In addition, because grain filling occurs at lower temperature for winter crops, an increase in yield potential could be expected for fall-sown oats in comparison to spring-sown oats. Currently, winter oat is grown is the south-eastern part of the US primarily for forage production. For the last three growing seasons, we evaluated some of the most winter hardy oat experimental lines and released cultivars from the Southern oat breeding programs for their survival in South Dakota. While winter survival ranged from 38.5 to 99.2% depending on the breeding line/cultivar during the 2015-2016 growing season, winter survival was poor during the 2016-2017 growing season. Plants which survived the winter were harvested and will be used as seed source for crossing to improve winter survival of oats.

ACKNOWLEDGEMENT

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Table 1. Performance of South Dakota breeding lines in the 2017 Uniform Early Performance Nursery (UEOPN) at South Dakota locations.

	SERF				Average§			
Entry	Yield (Bu/Acre)	Test weight (lb/Bu)	Crown Rust Severity (%)	Lodging (%)	Yield (Bu/Acre)	Test weight (lb/Bu)	Heading (Julian date)	Height (Inches)
SD141130	126.5	35.3	10	27.5	146.2	37.0	164.0	31.0
SD141070	125.5	34.0	30	5	144.3	35.7	163.5	28.8
SD140515	133.7	35.0	5	17.5	142.4	35.8	164.2	28.2
IL11-2537	118.1	31.8	65	12.5	141.5	34.7	163.2	30.5
SD120296	128.3	34.1	5	0	141.2	34.6	162.8	27.8
WIX9645-1	116.0	29.4	0	0	140.8	32.6	164.8	27.7
WIX10088-6	129.3	31.5	5	2.5	140.7	33.5	165.2	30.5
NATTY	115.1	33.8	20	35	140.1	35.5	163.5	32.5
SD140313	120.5	34.7	70	2.5	135.6	35.9	163.5	36.6
SD141043	111.2	34.7	0	0	134.3	35.8	164.2	30.3
MNBT1021-2	111.1	31.4	0	0	132.1	33.5	162.2	31.7
SD140962	119.7	34.1	5	7.5	130.2	35.3	163.7	35.2
IL12-6842	100.0	32.8	70	0	124.8	34.1	162.2	31.7
DON	101.4	31.4	100	2.5	121.8	34.5	163.3	29.5
IL09-5737	112.1	32.5	25	0	121.4	34.6	162.8	33.2
IL12-8726	93.7	34.0	35	0	121.3	35.4	162.2	34.7
WIX10305-4	104.4	33.6	0	0	121.1	36.3	163.2	33.5
KAME	88.8	26.4	70	7.5	119.6	31.2	163.3	30.5
CLINTFORD	99.6	30.9	55	30	119.2	33.0	162.8	25.7
WIX10097-2	98.2	36.1	35	2.5	118.6	38.1	161.8	33.5
CV	4.8	2.9			7.8	3.5	0.4	4.8
Mean	112.6	32.8			131.8	34.8	163.3	31.1
LSD	11.4	2.0			11.9	1.4	0.7	1.7

§: Averages over 3 locations (Volga, Northeast Research Farm and Southeast Research Farm).

SOUTHEAST RESEARCH FARM ANNUAL REPORT
South Dakota State University
2017 Progress Report
Agricultural Experiment Station
Plant Science Department
South Dakota State University, Brookings, SD 57007
Southeast Research Farm, Beresford SD 57004

WEED CONTROL DEMONSTRATIONS and EVALUATION TESTS for 2017

Southeast South Dakota Research Center
Paul O. Johnson*, Ext. Weed Science Coordinator; David Vos, SDSU Ag Research Manager, and Jill Alms, SDSU Ag Research Manager

INTRODUCTION

Experiment stations have an important role in the WEED (Weed Evaluation and Extension Demonstration) Project. Plots provide weed control data for the area served by the Southeast South Dakota Research Center. The station is one of the major sites for corn and soybean weed control studies. Tests at the station focus on common waterhemp, velvetleaf, marestail and foxtail.

2017 TESTS

Several studies were established to evaluate new weed control technologies. The demonstration plots centered around programs that would answer questions on the glyphosate resistance issue around the state, especially as it relates to waterhemp management in soybeans and corn. A wet spring was followed by a very dry summer until August. Some of the soybeans did not canopy until the rains came.

NOTE:

Data reported in this publication are results from field tests that include product uses, experimental products or experimental rates, combinations or other unlabeled uses for herbicide products. Trade names of products used are listed; there frequently are other brand products available in the market. Users are responsible for applying herbicide according to label directions. Refer to the appropriate weed control fact sheet available from regional extension offices or iGrow.org for herbicide recommendations.

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Studies listed below are summarized in the following tables. Information for each study is included as part of the summary.

1. Corn Herbicide Demonstration
2. Preemergence Herbicides in Corn
3. Weed Control & Crop Safety with ImpactZ Programs
4. Increased Liberty Rates in Corn
5. Acuron Burndown in No-Till Corn
6. DiFlexx Duo Comparisons
7. Post Broadleaf Options in Corn
8. Adjuvants with Roundup in Corn
9. Roundup Ready Soybean Demonstration
10. Liberty Link Soybean Demonstration
11. Dicamba Soybean Demonstration
12. Enlist Soybean Demonstration
13. Balance GT Soybeans
14. Fexapan in No-Till Two-Pass Programs
15. Soybean Programs for Resistance Management
16. Increased Liberty Rates in Soybeans
17. Zidua Programs for Weed Control in Dicamba-Tolerant Soybeans
18. Panther Pro Preplant and Preemergence in No-Till Soybeans
19. Fierce Plus Dicamba for Burndown in Dicamba-Tolerant Soybeans

ACKNOWLEDGEMENTS

We greatly appreciate the cooperation and assistance provided by the station personnel.

Due to the distance from the SDSU campus, assistance with field preparation and daily oversight of the fields is critical to the success of the weed control research. Field equipment and management of the plot areas are important contributions to the project. Regional Extension field specialists and program technicians provide assistance with tours and utilize the data in direct producer programs, publications and news releases. In addition to the Southeast Farm Report, research results will be published in the annual Weed Control Field Test Data Book, SDSU Pest Management Guides and Weed Control guides updated annually for major South Dakota commodities, and on the internet at www.iGrow.org.

Program input and partial support for field programs is also acknowledged.

South Dakota Soybean Research and Promotion Council

South Dakota Oilseed Initiative

South Dakota Wheat Commission

South Dakota Corn Utilization Council

Crop Protection Industries

2017
CORN HERBICIDE DEMONSTRATION
Southeast Research Farm

Treatment	Rate/A	Vele 6/7/17	Cowh 6/7/17	Vele 6/28/17	Cowh 6/28/17	Vele 7/18/17	Cowh 7/18/17	Yield Bu/A 10/24/17
Check	---	0 h	0 e	0 b	0 b	0 b	0 b	90 b
Pre & Post								
Harness & ImpactZ + RU Powermax + MSO + AMS	1.75 pt & 8 oz + 32 oz + 0.5% + 3.4 lb	64 d	95 ab	99 a	99 a	99 a	99 a	185 a
Resicore + Atrazine & Durango DMA + AMS	2.5 qt + 1 pt & 1 qt + 2.5%	99 a	99 a	99 a	99 a	99 a	99 a	185 a
Resicore + Atrazine & Resicore + Durango DMA + AMS	1.25 qt + 1 pt & 1.25 qt + 1 qt + 2.5%	99 a	99 a	99 a	99 a	99 a	99 a	175 a
Surestart II + Atrazine & Resicore + Durango DMA + AMS	2 pt + 1 pt & 1.25 qt + 1 qt + 2.5%	92 b	94 ab	96 a	99 a	98 a	99 a	198 a
Anthem Maxx & Solstice + Atrazine + RU Pmax + COC + AMS	4 oz & 2.5 oz + 1.5 pt + 32 oz + 0.5% + 1.7 lb	80 c	92 ab	99 a	99 a	99 a	99 a	188 a
Acuron & Halex GT + NIS	1.5 qt & 3.6 pt + 0.25%	99 a	99 a	99 a	99 a	99 a	99 a	178 a
Bicep Lite II Mag & Acuron Flexi + RU Powermax + AMS	1 pt & 1.25 qt + 21.3 oz + 3.4 lb	37 g	57 d	99 a	99 a	99 a	99 a	188 a
Dual II Mag & Callisto + RU Pmax + Atrazine + COC +AMS	1.33 pt & 3 oz + 32 oz + 1 pt + 1% + 1.7 lb	52 f	62 c	99 a	99 a	99 a	99 a	181 a
Corvus + Atrazine & RU Pmax + Laudis + DiFlexx + Destiny HC + AMS	3.5 oz + 1.5 pt & 32 oz + 3 oz + 8 oz + 0.5% + 3.4 lb	98 a	99 a	99 a	99 a	99 a	99 a	184 a
Corvus & Atrazine + Liberty + AMS	3.5 oz & 1 pt + 22 oz + 3 lb	98 a	99 a	99 a	99 a	99 a	99 a	194 a
Balance Flexx & Atrazine + Liberty + AMS	3.5 oz & 1 pt + 22 oz + 3 lb	97 a	99 a	99 a	99 a	99 a	99 a	189 a
Verdict & Status + RU Powermax + NIS + AMS	15 oz & 5 oz +22 oz + 0.25% + 2.5 lb	96 a	99 a	99 a	99 a	99 a	99 a	179 a
Harness & RU Powermax + Atrazine + AMS	1.75 pt & 22 oz + 1 pt + 2.5 lb	60 e	90 b	99 a	99 a	99 a	99 a	184 a
Breakfree NXT + Atrazine + Instigate & Abundit Edge + AMS	1.75 pt + 1 pt + 5.25 oz & 22 oz + 1.7 lb	97 a	97 a	99 a	99 a	99 a	99 a	183 a

Treatment	Rate/A	Vele 6/7/17	Cowh 6/7/17	Vele 6/28/17	Cowh 6/28/17	Vele 7/18/17	Cowh 7/18/17	Yield Bu/A 10/24/17
Epost								
Solstice + Atrazine + RU Powermax + COC + AMS	3.15 oz + 1 pt + 32 oz + 0.5% + 1.7 lb	--	--	99 a	99 a	99 a	99 a	180 a
Solstice + Anthem Maxx + Atrazine + RU Powermax + COC + AMS	2.5 oz + 2 oz + 1 pt + 32 oz + 0.5% + 1.7 lb	--	--	99 a	99 a	99 a	99 a	184 a
Realm Q + Atrazine + Abundit Edge + Breakfree NXT + AMS	4 oz + 1 pt + 22 oz + 1 pt + 1.7 lb	--	--	99 a	99 a	99 a	99 a	175 a
Armezon Pro + Atrazine + RU Powermax + COC + AMS	18 oz + 1 pt + 22 oz + 1% + 1.7 lb	--	--	99 a	99 a	99 a	99 a	186 a
Resicore + Atrazine + Durango DMA + AMS	1.25 qt + 1 pt + 1 qt + 2.5%	--	--	99 a	99 a	99 a	99 a	192 a
Epost & LPost								
RU Powermax + AMS & RU Powermax + AMS	22 oz + 2.5 lb & 22 oz + 2.5 lb	--	--	99 a	99 a	99 a	98 a	180 a
Liberty + AMS & Liberty + AMS	22 oz + 2.5 lb & 22 oz + 2.5 lb	--	--	99 a	99 a	99 a	97 a	185 a

RCB: 3 reps
Variety: DKC 53-56 RIB
Planting Date: 5/8/17
Pre: 5/9/17
Epost: 6/9/17 Corn V4 7-9 in; Vele 2-3 lf, 1-3 in; Cowh 0.5-3 in
Post: 6/15/17 Corn V5 15-20 in; Vele 2-7 in; Cowh 1 in.
Lpost: 6/20/17 Corn V6 24 in.

Precipitation: (inches)

Pre:	1st week 0.13	2nd week 3.10
Epost:	1st week 0.00	2nd week 0.71
Post:	1st week 0.71	2nd week 0.39
Lpost:	1st week 0.54	2nd week 0.89

Soil: Silty Clay; 3.5% OM; 6.6 pH

Vele=Velvetleaf
Cowh=Common waterhemp

P=0.05 (numbers in each column followed by the same letter are not significantly different)

Comments: Objective of study was to look at program treatments for corn weed control. Moderate velvetleaf and waterhemp weed pressure. With above normal moisture early in the season most preemergence treatments provided good to excellent control. All of the postemergence treatments provided excellent weed control. There were no differences in yield.

2017
PREEMERGENCE HERBICIDES in CORN
Southeast Research Farm

Treatment	Rate/A	Vele 6/7/17	Cowh 6/7/17	Vele 6/28/17	Cowh 6/28/17	Vele 7/18/17	Cowh 7/18/17	Yield bu/A 10/24/17
Check	---	0 e	0 c	0 e	0 f	0 d	0 f	82 d
Pre								
Anthem Maxx + Atrazine	4 oz + 1 pt	80 bc	93 b	67 c	96 c	37 c	91 e	131 c
Surestart II	2 pt	90 abc	97 a	84 ab	95 cd	80 b	96 b	146 c
Resicore	2.5 qt	92 ab	99 a	99 a	99 a	98 a	99 a	183 ab
Acuron	3 qt	99 a	99 a	99 a	99 a	99 a	99 a	183 ab
Acuron Flexi	2.25 qt	97 a	99 a	98 a	99 a	98 a	99 a	178 ab
Balance Flexx + Atrazine	3.5 oz + 1.5 pt	99 a	99 a	98 a	97 bc	96 a	97 ab	186 a
Corvus + Atrazine	3.5 oz + 1.5 pt	99 a	99 a	98 a	97 bc	94 a	97 ab	181 ab
Atrazine + Verdict	1 pt + 10 oz	96 a	98 a	87 a	95 cd	81 b	97 ab	174 ab
Outlook + Atrazine	1 pt + 1.5 pt	85 abc	99 a	70 bc	95 cd	43 c	96 bc	132 c
Breakfree NXT + Atrazine + Instigate	1.75 pt + 1 pt + 5.25 oz	99 a	99 a	99 a	99 a	97 a	99 a	179 ab
Harness	2.2 pt	75 c	98 a	72 bc	94 d	48 c	94 cd	129 c
Harness Xtra 6L	1.8 qt	85 abc	99 a	83 ab	98 ab	75 b	98 ab	147 bc
Bicep Lite II Mag	36 oz	57 d	97 a	52 d	90 e	42 c	93 d	113 c

RCB: 3 reps
Variety: DKC 53-56 RIB
Planting Date: 5/8/17
Pre: 5/9/17

Soil: Silty Clay; 3.5% OM; 6.6 pH

Precipitation: (inches)
Pre: 1st week 0.13 2nd week 3.10

Vele=Velvetleaf
Cowh=Common waterhemp

P=0.05 (numbers in each column followed by the same letter are not significantly different)

Comments: The purpose of this study was to evaluate preemergence corn treatments and the length of residual control they provided. Heavy waterhemp and velvetleaf weed pressure. Six treatments provided above 90 percent weed control of velvetleaf and were among the highest yielding treatments.

2017
WEED CONTROL & CROP SAFETY with IMPACTZ PROGRAMS
Southeast Research Farm

Treatment	Rate/A	Vele 6/13/17	VCRR 6/20/17	Vele 6/28/17	Cowh 6/28/17	Yeft 7/11/17	Vele 7/11/17	Cowh 7/11/17	Vele 7/25/17	Cowh 7/25/17	Yield bu/A 10/24/17
Check	---	0 d	0 c	0 b	0 b	0 b	0 c	0 b	0 b	0 b	89 b
Pre & Post											
Harness & ImpactZ + MSO + AMS	1.75 pt & 8 oz + 1% + 2.5%	68 c	5 b	99 a	99 a	99 a	98 ab	99 a	98 a	99 a	183 a
Harness & ImpactZ + RU Pmax + MSO + AMS	1.75 pt & 8 oz + 32 oz + 0.5% +2.5%	67 c	5 b	99 a	99 a	99 a	99 a	99 a	98 a	99 a	182 a
Harness & ImpactZ + Liberty + AMS	1.75 pt & 8 oz + 22 oz + 2.5%	68 c	5 b	99 a	99 a	99 a	98 ab	99 a	98 a	99 a	183 a
Epost											
Harness + ImpactZ + RU Powermax + NIS + AMS	1.75 pt + 8 oz + 32 oz + 0.25% + 2.5%	99 a	10 a	99 a	99 a	99 a	98 ab	99 a	97 a	99 a	182 a
Armezon Pro + RU Pmax + Atrazine + NIS+ AMS	20 oz + 32 oz + 0.5 pt + 0.25% + 2.5%	92 b	10 a	99 a	99 a	99 a	97 b	99 a	98 a	99 a	184 a

RCB: 4 reps
Variety: DKC 53-56 RIB
Planting Date: 5/8/17
Pre: 5/8/17
Epost: 6/9/17 Corn V4, 7-9 in; Vele 2-3 lf, 1-3 in;
Cowh 0.5-3 in; Yeft 2-4 lf, 2-5 in.
Post: 6/15/17 Corn V5, 15-20 in; Vele 2-7 in; Cowh 1 in.

Soil: Silty Clay; 3.5% OM; 6.6 pH

Precipitation: (inches)
Pre: 1st week 0.13 2nd week 3.10
Epost: 1st week 0.00 2nd week 0.71
Post: 1st week 0.71 2nd week 0.39

Vele=Velvetleaf
Cowh=Common waterhemp
Yeft=Yellow foxtail
VCRR=Visual Crop Response Rating
(0=no injury; 100=complete kill)

P=0.05 (numbers in each column followed by the same letter are not significantly different)

Comments: The objective of this study was to evaluate weed control and crop safety with the new herbicide Impactz. ImpactZ contains topramezone (Impact) and atrazine. Moderate velvetleaf and waterhemp, and light yellow foxtail pressure. All treatments provided excellent weed control.

2017
INCREASED LIBERTY RATES in CORN
Southeast Research Farm

Treatment	Rate/A	Vele 6/26/17	Cowh 6/26/17	VCRR 6/26/17	Vele 7/18/17	Cowh 7/18/17	Yield-bu/A Variety A 10/25/17	Yield-bu/A Variety B 10/25/17
Check	---	0 b	0 b	0 a	0 b	0 b	123 b	134 b
Pre* & Epost								
Liberty + AMS	32 oz + 1.7 lb	99 a	99 a	0 a	99 a	99 a	181 a	195 a
Liberty + AMS	36 oz + 1.7 lb	99 a	99 a	0 a	99 a	99 a	175 a	194 a
Liberty + AMS	43 oz + 1.7 lb	99 a	99 a	0 a	99 a	99 a	181 a	203 a
Liberty + Atrazine + AMS	32 oz + 2 pt + 1.7 lb	99 a	99 a	0 a	99 a	99 a	180 a	197 a
Liberty + Atrazine + AMS	36 oz + 2 pt + 1.7 lb	99 a	99 a	0 a	99 a	99 a	175 a	204 a
Liberty + Atrazine + AMS	43 oz + 2 pt + 1.7 lb	99 a	99 a	0 a	99 a	99 a	175 a	198 a
Liberty + Laudis + AMS	22 oz + 3 oz + 1.7 lb	99 a	99 a	0 a	99 a	99 a	180 a	199 a
Liberty + Laudis + AMS	32 oz + 3 oz + 1.7 lb	99 a	99 a	0 a	99 a	99 a	173 a	196 a
Liberty + Laudis + AMS	43 oz + 3 oz + 1.7 lb	99 a	99 a	0 a	99 a	99 a	179 a	189 a
Liberty + DiFlexx + AMS	22 oz + 10 oz + 1.7 lb	99 a	99 a	0 a	99 a	99 a	173 a	197 a
Liberty + DiFlexx + AMS	32 oz + 10 oz + 1.7 lb	99 a	99 a	0 a	99 a	99 a	178 a	195 a
Liberty + DiFlexx + AMS	43 oz + 10 oz + 1.7 lb	99 a	99 a	0 a	99 a	99 a	176 a	199 a
Pre* & Epost & Post								
Liberty + Atrazine + AMS & Liberty + AMS	22 oz + 2 pt + 1.7 lb & 32 oz + 1.7 lb	99 a	99 a	0 a	99 a	99 a	180 a	193 a
Liberty + Atrazine + AMS & Liberty + AMS	32 oz + 2 pt + 1.7 lb & 32 oz + 1.7 lb	99 a	99 a	0 a	99 a	99 a	182 a	195 a

*Balance Flexx (3 oz/A) + Atrazine (2 pt/A) applied Pre to all treatments.

RCB: 4 reps
Planting Date: 5/8/17
Pre: 5/9/17
Epost: 6/15/17 Corn V5, 15-20 in; Vele 2-7 in; Cowh 1 in.
Post: 6/26/17 Corn V7 36 in.

Precipitation: (inches)
Pre: 1st week 0.13 2nd week 3.10
Epost: 1st week 0.71 2nd week 0.39
Post: 1st week 0.87 2nd week 0.02

Soil: Silty Clay; 3.5% OM; 6.6 pH

Vele=Velvetleaf
Cowh=Common waterhemp
VCRR=Visual Crop Response Rating
(0=no injury; 100=complete kill)

P=0.05 (numbers in each column followed by the same letter are not significantly different)

Comments: Objective of the study was to evaluate increased rates of Liberty for crop safety and weed control. Moderate velvetleaf and waterhemp weed pressure. Two varieties of corn with different trait packages were evaluated. No crop injury was observed and all treatments provided excellent weed control.

2017
ACURON BURNDOWN in NO-TILL CORN
Southeast Research Farm

Treatment	Rate/A	Prle 5/22/17	Dali 5/22/17	Prle 5/31/17	Dali 5/31/17	Prle 6/7/17	Dali 6/7/17
Check	---	0 d	0 f	0 c	0 e	0 c	0 e
Burndown							
Acuron + COC + AMS	2.5 qt + 1% + 2.5%	97 a	66 b	99 a	86 a	99 a	79 a
Acuron + COC + AMS	1.5 qt + 1% + 2.5%	97 a	60 c	99 a	81 ab	99 a	59 c
Resicore + COC + AMS	1.25 qt + 1% + 2.5%	85 b	50 d	95 a	50 c	99 a	28 d
Corvus + COC + AMS	3.33 oz + 1% + 2.5%	69 c	35 e	78 b	28 d	65 b	25 d
Acuron + Gramoxone + NIS + AMS	1.5 qt + 2.5 pt + 0.25% + 2.5%	99 a	76 a	99 a	75 b	99 a	53 c
Acuron + 2,4-D ester + COC + AMS	1.5 qt + 1 pt + 1% + 2.5%	91 a	68 b	99 a	80 ab	99 a	71 b

RCB: 4 reps
Variety: DKC 53-56 RIB
Planting Date: 5/15/17
Burndown: 5/9/17 Dali 8-12 in blooming; Prle 4-6 lf, 6-8 in.

Soil: Clay; 3.1% OM; 7.1 pH

Precipitation: (inches)
Bdown: 1st week 0.13   2nd week 3.10

Prle=Prickly lettuce
Dali=Dandelion

P=0.05 (numbers in each column followed by the same letter are not significantly different)

Comments: The objective of this study was to evaluate burndown treatments with Acuron in no-till corn. Prickly lettuce control was excellent with all of the Acuron treatments. Dandelion control was more variable; however, two treatments provided fair to good control mid-season.

2017
DIFLEXX DUO COMPARISONS
Southeast Research Farm

Treatment	Rate/A	VCRR 6/20/17	Yeft 6/28/17	Vele 6/28/17	Cowh 6/28/17	Yeft 7/25/17	Vele 7/25/17	Cowh 7/25/17	Yield bu/A 10/24/17
Check	---	0 a	0 c	0 b	0 b	0 c	0 b	0 b	82 b
Post									
DiFlexx Duo + RU Pmax + Aatrex + AMS	32 oz + 32 oz + 16 oz + 1.7 lb	0 a	99 a	99 a	99 a	99 a	99 a	99 a	177 a
DiFlexx Duo + Aatrex + COC + AMS	32 oz + 16 oz + 1% + 1.7 lb	0 a	65 b	99 a	99 a	76 b	99 a	99 a	165 a
DiFlexx Duo + RU Pmax + Aatrex + AMS	24 oz + 32 oz + 16 oz + 1.7 lb	0 a	99 a	99 a	99 a	99 a	99 a	99 a	181 a
DiFlexx Duo + Liberty + Aatrex + AMS	24 oz + 32 oz + 16 oz + 1.7 lb	0 a	99 a	99 a	99 a	99 a	99 a	99 a	181 a
Capreno + RU Powermax + Aatrex + AMS	3 oz + 32 oz + 16 oz + 1.7 lb	0 a	99 a	99 a	99 a	99 a	99 a	99 a	176 a
Halex GT + Aatrex + NIS + AMS	57.6 oz + 16 oz + 0.25% + 1.7 lb	0 a	99 a	99 a	99 a	99 a	99 a	99 a	183 a
Armezon + Outlook + RU Pmax + Aatrex + AMS	0.57 oz + 14 oz + 32 oz + 16 oz + 1.7 lb	0 a	99 a	99 a	99 a	99 a	99 a	99 a	187 a
Armezon + Status + RU Pmax + Aatrex + AMS	0.57 oz + 3 oz + 32 oz + 16 oz + 1.7 lb	0 a	99 a	99 a	99 a	99 a	99 a	99 a	170 a
Resicore + Atrazine + RU Powermax + AMS	1.25 qt + 1 pt + 32 oz + 1.7 lb	0 a	99 a	99 a	99 a	99 a	99 a	99 a	183 a
Realm Q + Atrazine + RU Powermax + AMS	4 oz + 1 pt + 32 oz + 1.7 lb	0 a	99 a	99 a	99 a	99 a	99 a	99 a	174 a

RCB: 4 reps
Variety: DKC 53-56 RIB
Planting Date: 5/8/17
Post: 6/15/17 Corn V5, 15-20 in; Yeft 3-6 in; Vele 2-7 in; Cowh 1-3 in.

Precipitation: (inches)
Post: 1st week 0.71 2nd week 0.39

Soil: Silty Clay; 3.5% OM; 6.6 pH

Yeft=Yellow foxtail
Vele=Velvetleaf
Cowh=Common waterhemp

P=0.05 (numbers in each column followed by the same letter are not significantly different)

Comments: The objective of this study was to compare Diflexx Duo to other post emergence treatments in corn. Moderate velvetleaf and waterhemp pressure, and light yellow foxtail pressure. Broadleaf weed control was excellent and yellow foxtail control was excellent in all but one treatment that showed marginal to fair control. There were no differences in yield.

2017
POST BROADLEAF OPTIONS in CORN
Southeast Research Farm

Treatment	Rate/A	Vele 7/18/17	Cowh 7/18/17	Vele 7/25/17	Cowh 7/25/17
Check	---	0 g	0 d	0 j	0 d
Post					
RU Powermax + AMS	32 oz + 1.7 lb	93 ab	90 a	86 cd	86 ab
Liberty + AMS	29 oz + 1.7 lb	43 f	73 b	30 i	92 ab
Laudis + MSO + AMS	3 oz + 1% + 1.7 lb	93 ab	94 a	94 ab	97 a
Capreno + COC + AMS	3 oz + 1% + 1.7 lb	97 a	93 a	96 a	93 ab
Aim + COC	1 oz + 1%	78 d	43 c	80 ef	33 c
Resource + COC + AMS	6 oz + 1% + 2.5 lb	78 d	47 c	72 g	33 c
Cadet + COC + AMS	0.4 oz + 1% + 1.7 lb	83 cd	43 c	77 fg	30 c
Solstice + COC + AMS	3.15 oz + 1% + 1.7 lb	98 a	85 a	97 a	85 b
Callisto + COC + AMS	3 oz + 1% + 1.7 lb	91 abc	75 b	93 ab	85 b
Acuron Flexi + COC	2.25 qt + 1%	98 a	95 a	98 a	97 a
Status + MSO +AMS	5 oz + 1 pt + 1.7 lb	94 ab	89 a	89 bc	89 ab
DiFlexx + MSO + AMS	8 oz + 0.5% + 1.7 lb	86 bcd	88 a	75 fg	91 ab
DiFlexx Duo + COC + AMS	32 oz + 1% + 3.4 lb	99 a	95 a	98 a	96 a
Impact + MSO + AMS	0.75 oz + 1% + 1.7 lb	80 d	93 a	83 de	87 ab
Buctril + Atrazine	1.5 pt + 1.5 pt	63 e	95 a	55 h	92 ab

RCB: 3 reps
Variety: DKC 53-56 RIB
Planting Date: 5/15/17
Post: 6/20/17 Corn V5, 16-18 in; Vele 4-10 in; Cowh 2-12 in.

Precipitation: (inches)
Post: 1st week 0.54 2nd week 0.89

Soil: Silty Clay; 3.5% OM; 6.6 pH

Vele=Velvetleaf
Cowh=Common waterhemp

P=0.05 (numbers in each column followed by the same letter are not significantly different)

Comments: The objective of this study was to evaluate options for postemergence control of broadleaf weeds. Weeds were larger than label recommendations at time of application. Most of the treatments provided good to excellent control of common waterhemp and only six treatments provided excellent control of velvetleaf.

2017
ADJUVANTS with ROUNDUP in CORN
Southeast Research Farm

Treatment	Rate/A	Vele 7/5/17	Cowh 7/5/17	Vele 7/18/17	Cowh 7/18/17
Check	---	0 d	0 d	0 d	0 d
Post					
RU Powermax	16 oz	50 c	63 c	47 c	40 c
RU Powermax + AMS	16 oz + 3.4 lb	93 a	68 bc	90 a	63 b
RU Powermax + X-celerate	16 oz + 0.38%	70 b	62 c	77 b	62 b
RU Powermax + N Pak AMS	16 oz + 2 qt	94 a	79 abc	91 a	66 b
RU Powermax + Class Act Ridion	16 oz + 1%	63 b	85 ab	50 c	68 b
RU Powermax	32 oz	95 a	93 a	92 a	83 a
RU Powermax + AMS	32 oz + 3.4 lb	95 a	87 ab	98 a	84 a
RU Powermax + X-celerate	32 oz + 0.38%	94 a	88 ab	95 a	82 a
RU Powermax + N Pak AMS	32 oz + 2 qt	92 a	86 ab	98 a	85 a
RU Powermax + Class Act Ridion	32 oz + 1%	93 a	89 ab	91 a	88 a

RCB: 3 reps
Variety: DKC 53-56 RIB
Planting Date: 5/15/17
Post: 6/20/17 Corn V5, 16-18 in; Vele 4-10 in; Cowh 2-12 in.

Precipitation: (inches)
Post: 1st week 0.54 2nd week 0.89

Soil: Silty Clay; 3.5% OM; 6.6 pH

Vele=Velvetleaf
Cowh=Common waterhemp

P=0.05 (numbers in each column followed by the same letter are not significantly different)

Comments: Objective of study was to compare adjuvants with Roundup Powermax to determine if there are additive effects. Weeds were large at the time of application. Some control differences were observed when tank-mixed with a reduced rate of glyphosate; however, there were no differences with the full rate of glyphosate.

2017
ROUNDUP READY SOYBEAN DEMONSTRATION
Southeast Research Farm

Treatment	Rate/A	Vele 6/26/17	Cowh 6/26/17	Vele 7/19/17	Cowh 7/19/17	Yield bu/A 10/18/17
Check	---	0 c	0 c	0 e	0 g	10 d
PPI & Post						
Treflan + Dimetric & RU Powermax + AMS	1.5 pt + 0.33 lb & 22 oz + 2 qt	89 a	92 a	94 abc	94 ab	44 ab
Prowl H2O + Dimetric & RU Powermax + AMS	3 pt + 0.33 lb & 22 oz + 2 qt	85 a	95 a	92 abc	95 a	49 ab
Pre & Post						
Sonic & Flexstar + Select Max + COC	5 oz & 1 pt + 12 oz + 0.25%	90 a	85 a	92 abc	96 a	41 ab
Authority MTZ & Avalanche Ultra + Section 3 + NIS	14 oz & 1.5 pt+5.33 oz +0.25%	90 a	79 a	66 d	72 f	24 c
Authority MTZ & RU Powermax + AMS	14 oz & 32 oz + 2 qt	89 a	80 a	97 ab	84 de	41 ab
Sonic + Dimetric & Durango DMA + AMS	4.5 oz + 4 oz & 1 qt +2.5%	89 a	81 a	98 a	87 cde	47 ab
Surveil + Dimetric & Durango DMA + AMS	3.25 oz + 4 oz & 1 qt + 2.5%	93 a	86 a	98 a	94 ab	55 a
Sonic & Flexstar + Durango DMA + COC + AMS	4.5 oz & 12 oz + 1 qt +0.5% +2.5%	93 a	85 a	97 ab	97 a	49 ab
Sonic & Dual II Mag + Durango DMA + AMS	4.5 oz & 1 pt + 1 qt + 2.5%	90 a	86 a	98 a	86 cde	45 ab
Authority Assist & Anthem Maxx + RU Powermax + COC + AMS	6 oz & 3 oz + 32 oz + 1 pt + 1.7 lb	93 a	85 a	98 a	89 bcd	48 ab
Authority MTZ & Anthem Maxx + RU Powermax + COC + AMS	14 oz & 3 oz + 32 oz + 1 pt + 1.7 lb	91 a	84 a	96 ab	88 cd	40 ab
Authority Elite & Marvel + RU Powermax + COC + AMS	28 oz & 7.25 oz + 32 oz + 1 pt + 1.7 lb	92 a	86 a	95 abc	97 a	43 ab
Boundary & Flexstar GT + Dual Mag +AMS	1.8 pt & 3.5 pt + 1 pt + 1.7 lb	91 a	84 a	94 abc	96 a	44 ab
Broadaxe XC & Flexstar GT + Dual Mag +AMS	25 oz & 3.5 pt + 1 pt + 1.7 lb	92 a	85 a	95 abc	97 a	46 ab
Boundary & Prefix + RU Powermax + AMS	1.8 pt & 2 pt + 22 oz + 1.7 lb	91 a	83 a	91 bc	97 a	45 ab
Afforia + Dimetric & Cinch + Abundit Edge + AMS	2.5 oz + 5 oz & 1 pt + 32 oz + 2 qt	91 a	84 a	95 abc	91 abc	47 ab

Treatment	Rate/A	Vele 6/26/17	Cowh 6/26/17	Vele 7/19/17	Cowh 7/19/17	Yield bu/A 10/18/17
Pre & Post						
Afforia + Dimetric & Abundit Edge + Assure II + Flexstar + NIS + AMS	2.5 oz + 4 oz & 32 oz + 5 oz + 12 oz + 0.25% + 2 qt	93 a	91 a	90 c	97 a	45 ab
Optill + Zidua & RU Powermax + AMS	2 oz + 2 oz & 22 oz + 2 qt	87 a	87 a	98 a	81 e	40 ab
Zidua + Verdict & RU Pmax + Extreme + AMS	2.5 oz + 5 oz & 22 oz + 2.25 pt + 2 qt	88 a	87 a	98 a	88 cd	43 ab
Warrant & RU Pmax + AMS	1.5 qt & 22 oz + 2 qt	75 a	76 a	93 abc	85 cde	34 b
Fierce & RU Powermax + AMS	3 oz & 22 oz + 2 qt	88 a	86 a	96 abc	89 bcd	39 ab
Valor + Dimetric & RU Powermax + AMS	2 oz + 5.33 oz & 22 oz +2 qt	90 a	86 a	98 a	85 de	42 ab
Epost & Lpost						
RU Powermax + AMS & RU Powermax + AMS	22 oz + 2 qt & 22 oz + 2 qt	43 b	41 b	98 a	88 cd	47 ab

RCB: 4 reps
Variety: AG 20X7
Planting Date: 5/30/17
PPI: 5/30/17
Pre: 5/31/17
Epost: 6/20/17 Soy cot-2 tri, 1-4 in; Vele 2-3 in; Cowh 1-4 in.
Post: 6/26/17 Soy uni-2 tri, 2-5 in; Vele 2-4 in; Cowh 1-6 in.
Lpost: 7/6/17 Soy 2-5 tri, 5-9 in; Cowh 5-12 in.

Precipitation: (inches)
PPI/Pre: 1st week 0.02 2nd week 0.00
Epost: 1st week 0.54 2nd week 0.89
Post: 1st week 0.87 2nd week 0.02
Lpost: 1st week 0.00 2nd week 0.01

Soil: Clay; 3.8% OM; 7.4 pH

Vele=Velvetleaf
Cowh=Common waterhemp

P=0.05 (numbers in each column followed by the same letter are not significantly different)

Comments: The objective of the study was to evaluate program treatments for soybean weed control. Moderate velvetleaf and waterhemp weed pressure. Eleven treatments provided above 90 precent weed control season long and yielded above 40 bushels.

2017
LIBERTY LINK SOYBEAN DEMONSTRATION
Southeast Research Farm

Treatment	Rate/A	Cowh 6/26/17	Vele 7/19/17	Cowh 7/19/17	Yield bu/A 10/17/17
Check	---	0 e	0 b	0 d	14 c
Pre & Post					
Authority First & Liberty + AMS	6.5 oz & 29 oz + 1.7 lb	88 bc	99 a	91 abc	42 ab
Valor & Liberty + AMS	2.5 oz & 29 oz + 1.7 lb	91 b	97 a	95 ab	39 ab
Fierce & Liberty + AMS	3.5 oz & 29 oz + 1.7 lb	94 a	96 a	97 a	47 a
Boundary & Liberty + AMS	1.8 pt & 29 oz + 1.7 lb	86 c	93 a	90 bc	41 ab
Authority MTZ & Cheetah + AMS	14 oz & 29 oz + 1.5 lb	82 d	97 a	88 c	37 b
Epost & Lpost					
Cheetah + AMS & Cheetah + AMS	29 oz + 1.5 lb & 29 oz + 1.5 lb	--	99 a	96 a	46 a

RCB: 4 reps
Variety: LC 2250
Planting Date: 5/30/17
Pre: 5/31/17
Epost: 6/20/17 Soy cot-2 tri, 1-4 in; Cowh 1-4 in; Vele 2-3 in.
Post: 6/26/17 Soy uni-2 tri, 2-5 in; Cowh 1-6 in; Vele 2-4 in.
Lpost: 7/6/17 Soy 2-5 tri, 5-9 in; Cowh 5-12 in.

Precipitation: (inches)

Pre:	1st week 0.02	2nd week 0.00
Epost:	1st week 0.54	2nd week 0.89
Post:	1st week 0.87	2nd week 0.02
Lpost:	1st week 0.00	2nd week 0.01

Soil: Clay; 3.8% OM; 7.4 pH

Cowh=Common waterhemp
Vele=Velvetleaf

P=0.05 (numbers in each column followed by the same letter are not significantly different)

Comments: The objective of the study was to evaluate program treatments for weed control in Liberty Link soybeans. Moderate velvetleaf and waterhemp weed pressure. All treatments that provided above 90 percent season long weed control were in the top yield group.

2017
DICAMBA SOYBEAN DEMONSTRATION
Southeast Research Farm

Treatment	Rate/A	Vele 6/26/17		Colq 6/26/17		Vele 7/19/17		Cowh 7/19/17		Yield Bu/A 10/17/17	
Check	---	0	c	0	d	0	b	0	c	16	b
Pre & Post											
Sonic & RU Powermax + Engenia + Class Act Ridion	6.5 oz & 32 oz + 12.8 oz + 1%	90	a	85	a	98	a	92	b	56	a
Panther & RU Powermax + Engenia + Class Act Ridion	2.5 oz & 32 oz + 12.8 oz + 1%	90	a	83	ab	97	a	93	b	53	a
Fierce & Abundit Edge + Fexapan + Class Act Ridion	3.5 oz & 32 oz + 22 oz + 1%	90	a	84	ab	97	a	97	a	58	a
Afforia & Abundit Edge + Fexapan + Class Act Ridion	2.5 oz & 32 oz + 22 oz + 1%	90	a	77	b	97	a	96	a	57	a
Authority MTZ & RU Powermax + Xtendimax + Class Act Ridion	14 oz & 32 oz + 22 oz + 1%	90	a	79	ab	94	a	92	b	52	a
Boundary & RU Powermax + Xtendimax + Class Act Ridion	1.8 pt & 32 oz + 22 oz + 1%	87	b	70	c	98	a	97	a	55	a
Rowel & Warrant + RU Powermax + Xtendimax + Class Act Ridion	2 oz & 48 oz + 32 oz + 22 oz + 1%	89	a	81	ab	96	a	92	b	53	a

RCB: 4 reps
Variety: AG 20X7
Planting Date: 5/30/17
Pre: 5/31/17
Post: 6/26/17 Soy uni-2 tri, 2-5 in; Vele 2-4 in; Colq 2-6 in; Cowh 1-6 in.

Precipitation: (inches)
Pre: 1st week 0.02 2nd week 0.00
Post: 1st week 0.87 2nd week 0.02

Soil: Clay; 3.8% OM; 7.4 pH

Vele=Velvetleaf
Colq=Common lambsquarters
Cowh=Common waterhemp

P=0.05 (numbers in each column followed by the same letter are not significantly different)

Comments: The objective of study was to compare different programs using dicamba tolerant soybeans. Moderate velvetleaf and waterhemp weed pressure. All treatments provided above 90 percent weed control and there were no differences in yield.

2017
ENLIST SOYBEAN DEMONSTRATION
Southeast Research Farm

Treatment	Rate/A	Vele 6/26/17	Cowh 6/26/17	Vele 7/19/17	Cowh 7/19/17	Yield bu/A 10/17/17
Pre & Post						
Sonic &	4.5 oz &	92 a	80 b	94 ab	96 a	40 a
Enlist One + Liberty + AMS	24 oz + 29 oz + 2.5%					
Sonic &	4.5 oz &	91 a	80 b	95 ab	97 a	39 a
Enlist One + Liberty + AMS	32 oz + 29 oz + 2.5%					
Sonic &	4.5 oz &	91 a	81 ab	96 a	98 a	41 a
Enlist One + Durango DMA + AMS	32 oz + 32 oz + 2.5%					
Sonic &	4.5 oz &	92 a	82 ab	97 a	96 a	42 a
Enlist Duo + AMS	56 oz + 2.5%					
Sonic &	4.5 oz &	91 a	83 a	91 b	94 b	35 a
Durango DMA + Flexstar + AMS	32 oz + 0.75 pt + 2.5%					
Check	---	0 b	0 c	0 c	0 c	7 b

RCB: 3 reps
Variety: Enlist E3
Planting Date: 5/30/17
Pre: 5/31/17
Post: 6/26/17 Soy uni-2 tri, 2-5 in; Vele 2-4 in; Cowh 1-6 in.

Precipitation: (inches)
Pre: 1st week 0.02 2nd week 0.00
Post: 1st week 0.87 2nd week 0.02

Soil: Clay; 3.8% OM; 7.4 pH

Vele=Velvetleaf
Cowh=Common waterhemp

P=0.05 (numbers in each column followed by the same letter are not significantly different)

Comments: The objective of the study was to compare different programs using 2,4-D tolerant soybeans. Moderate velvetleaf and waterhemp weed pressure. All treatments provided excellent weed control. The conventional herbicide check was a little lower in season long weed control and the lowest in yield however not significantly.

2017
BALANCE GT SOYBEANS
Southeast Research Farm

Treatment	Rate/A	VCRR 6/12/17	Vele 6/26/17	Cowh 6/26/17	Vele 7/19/17	Cowh 7/19/17	Yield bu/A 10/17/17
Check	---	0 a	0 d	0 b	0 d	0 c	13 b
Pre & Epost							
Balance Bean + Spartan & RU Powermax + AMS	3 oz + 5 oz & 32 oz + 1.7 lb	0 a	85 bc	84 a	99 a	89 ab	43 a
Balance Bean + Dual II Mag & RU Powermax + AMS	3 oz + 16 oz & 32 oz + 1.7 lb	0 a	84 c	87 a	98 a	90 ab	39 a
Balance Bean + Zidua & RU Powermax + AMS	3 oz + 1.55 oz & 32 oz + 1.7 lb	0 a	90 ab	86 a	99 a	88 b	40 a
Fierce & RU Powermax + AMS	3 oz & 32 oz + 1.7 lb	0 a	92 a	88 a	90 c	93 a	45 a
Balance Bean + Valor & RU Powermax + AMS	3 oz + 2 oz & 32 oz + 1.7 lb	0 a	92 a	86 a	99 a	91 ab	45 a
Balance Bean + Dimetric & RU Powermax + AMS	3 oz + 5.33 oz & 32 oz + 1.7 lb	0 a	91 a	83 a	99 a	90 ab	38 a
Balance Bean + Warrant & RU Powermax + AMS	3 oz + 3 pt & 32 oz + 1.7 lb	0 a	90 ab	89 a	99 a	94 a	41 a
Authority MTZ & RU Powermax + AMS	14 oz & 32 oz + 1.7 lb	0 a	87 abc	85 a	95 b	90 ab	44 a
Sonic & RU Powermax + AMS	6 oz & 32 oz + 1.7 lb	0 a	93 a	82 a	99 a	90 ab	44 a

RCB: 3 reps
Variety: Stine 19BA23
Planting Date: 5/16/17
Pre: 5/31/17
Epost: 6/26/17 Soy uni-2 tri, 2-5 in; Vele 2-4 in; Cowh 1-6 in.

Precipitation: (inches)
Pre: 1st week 0.02 2nd week 0.00
Epost: 1st week 0.87 2nd week 0.02

Soil: Clay; 3.8% OM; 7.4 pH

Vele=Velvetleaf
Cowh=Common waterhemp
VCRR=Visual Crop Response Rating
(0=no injury; 100=complete kill)

P=0.05 (numbers in each column followed by the same letter are not significantly different)

Comments: Balance Bean herbicide is experimental use only. Labeling expected in 2018. The objective of study was to evaluate Balance GT soybeans with Balance Bean herbicide compared to standard treatments. Moderate velvetleaf and waterhemp pressure. All treatments provided good weed control and were in the top yield group.

2017
FEXAPAN in NO-TILL TWO-PASS PROGRAMS
Southeast Research Farm

Treatment	Rate/A	Fipc 5/22/17	Mata 5/22/17	Fipc 5/31/17	Mata 5/31/17	Prle 6/26/17	Mata 7/5/17	Cowh 7/18/17	Cowh 8/14/17	Yield bu/A 10/17/17
Pre & Post										
Afforia + Abundit Edge + Fexapan & Abundit Edge + Fexapan	2.5 oz + 22 oz + 22 oz & 22 oz + 22 oz	95 a	81 a	99 a	95 bc	99 a	99 a	98 a	97 a	55 a
Afforia + Abundit Edge + Fexapan & Abundit Edge + Fexapan + Cinch	2.5 oz + 22 oz + 22 oz & 22 oz + 22 oz + 1 pt	91 a	81 a	99 a	95 bc	99 a	98 a	98 a	99 a	56 a
Enlite + Abundit Edge + Fexapan & Abundit Edge + Fexapan	2.8 oz + 22 oz + 22 oz & 22 oz + 22 oz	90 a	83 a	99 a	98 a	99 a	99 a	97 a	98 a	57 a
Enlite + Abundit Edge + Fexapan & Abundit Edge + Fexapan + Cinch	2.8 oz + 22 oz + 22 oz & 22 oz + 22 oz + 1 pt	83 a	82 a	99 a	96 b	99 a	99 a	98 a	97 a	54 a
Authority MTZ + Abundit Edge + Fexapan & Abundit Edge + Fexapan	14 oz + 22 oz + 22 oz & 22 oz + 22 oz	81 a	81 a	99 a	94 c	99 a	99 a	97 a	96 a	50 a
Check	---	0 b	0 b	0 b	0 d	0 b	0 b	0 b	0 b	2 b

RCB: 3 reps
Variety: AG 20X7
Planting Date: 6/1/17
Pre: 5/12/17 Fipc 16-24 in; Mata 1-6 in; Prle 4-6 in; 6-12 in diam; Cowh cot.-1 in.
Post: 6/26/17 Soy 2-3 tri, 5-7 in; Mata 3-5 in.

Precipitation: (inches)
Pre: 1st week 2.11 2nd week 1.17
Post: 1st week 0.87 2nd week 0.02

Soil: Clay; 3.0% OM; 7.8 pH

Fipc=Field pennycress
Mata=Marestail
Prle=Prickly lettuce
Cowh=Common waterhemp

P=0.05 (numbers in each column followed by the same letter are not significantly different)

Comments: Objective of the study was to evaluate Fexapan programs in no-till soybeans. Heavy field pennycress and prickly lettuce pressure and light waterhemp weed pressure. Waterhemp emerged later in the season. All treatments provided excellent weed control and there were no differences in yield.

2017
SOYBEAN PROGRAMS for RESISTANCE MANAGEMENT
Southeast Research Farm

Treatment	Rate/A	VCRR 6/12/17	Vele 6/26/17	Cowh 6/26/17	Vele 7/11/17	Cowh 7/11/17	Vele 7/25/17	Cowh 7/25/17	Vele 8/14/17	Cowh 8/14/17
Pre & Post										
Enlite & Liberty + Cinch + AMS	2.8 oz & 29 oz + 1 pt + 2 lb	0 a	85 a	84 a	97 a	97 a	90 a	92 a	80 a	82 ab
Enlite + Zidua & Liberty + Cinch + AMS	2.8 oz + 1.5 oz & 29 oz + 1 pt + 2 lb	0 a	88 a	88 a	97 a	98 a	90 ab	94 a	82 a	84 a
Enlite + Dimetric & Liberty + Cinch + AMS	2.8 oz + 6 oz & 29 oz + 1 pt + 2 lb	0 a	86 a	86 a	96 a	97 a	89 ab	91 a	73 a	81 ab
Afforia & Liberty + AMS	2.5 oz & 29 oz + 2 lb	0 a	87 a	82 a	95 a	96 a	84 ab	91 a	63 b	83 ab
Afforia & Liberty + Cinch + AMS	2.5 oz & 29 oz + 1 pt + 2 lb	0 a	84 a	85 a	96 a	97 a	84 ab	92 a	56 b	82 ab
Afforia + Zidua & Liberty + Cinch + AMS	2.5 oz + 1.5 oz & 29 oz + 1 pt + 2 lb	0 a	89 a	87 a	96 a	98 a	85 ab	94 a	59 b	85 a
Afforia & Liberty + Cinch + AMS	3.75 oz & 29 oz + 1 pt + 2 lb	0 a	87 a	83 a	96 a	93 a	93 a	94 a	58 b	81 ab
Authority Elite & Liberty + Cinch + AMS	25 oz & 29 oz + 1 pt + 2 lb	0 a	75 b	81 a	90 b	96 a	96 a	93 a	35 c	79 b
Check	---	0 a	0 c	0 b	0 c	0 b	0 b	0 b	0 d	0 c

RCB: 4 reps
Variety: LC 2250
Planting Date: 5/30/17
Pre: 5/31/17
Post: 6/26/17 Soy uni-2 tri, 2-5 in; Cowh 1-6 in; Vele 2-4 in.

Soil: Clay; 3.8% OM; 7.4 pH

Precipitation: (inches)
Pre: 1st week 0.02 2nd week 0.00
Post: 1st week 0.87 2nd week 0.02

Cowh=Common waterhemp
Vele=Velvetleaf

P=0.05 (numbers in each column followed by the same letter are not significantly different)

Comments: Objective of the study was to look at soybean programs for resistance management. Moderate velvetleaf and waterhemp weed pressure. All programs resulted in good control early, however the Enlite programs provided longer residual control of velvetleaf.

2017
INCREASED LIBERTY RATES in SOYBEANS
Southeast Research Farm

Treatment	Rate/A	VCRR 6/12/17	Cowh 6/26/17	VCRR 6/26/17	Vele 7/11/17	Cowh 7/11/17	VCRR 7/11/17	Vele 7/18/17	Cowh 7/18/17	Yield bu/A 10/17/17
Check	---	0 a	0 c	0 a	0 b	0 c	0 a	0 b	0 d	15 b
Pre & Epost										
Authority First & Liberty + AMS	6.5 oz & 32 oz + 1.7 lb	0 a	97 a	0 a	99 a	96 b	0 a	99 a	93 c	49 a
Authority First & Liberty + Cadet + AMS	6.5 oz & 32 oz + 0.5 oz + 1.7 lb	0 a	97 a	0 a	99 a	98 a	0 a	99 a	93 c	49 a
Authority First & Liberty + Anthem + AMS	6.5 oz & 32 oz + 7 oz + 1.7 lb	0 a	97 a	0 a	99 a	98 a	0 a	99 a	96 b	52 a
Pre & Post										
Authority First & Liberty + AMS	6.5 oz & 43 oz + 1.7 lb	0 a	94 b	0 a	99 a	99 a	0 a	99 a	98 a	57 a
Pre & Epost & Post										
Authority First & Liberty + AMS & Liberty + AMS	6.5 oz & 32 oz + 1.7 lb & 32 oz + 1.7 lb	0 a	97 a	0 a	99 a	99 a	0 a	99 a	99 a	55 a
Authority MTZ & Liberty + Flexstar + AMS & Liberty + AMS	14 oz & 32 oz + 1 pt + 1.7 lb & 32 oz + 1.7 lb	0 a	97 a	0 a	99 a	99 a	0 a	99 a	99 a	55 a
Valor & Liberty + Cobra + AMS & Liberty + AMS	2 oz & 32 oz + 12.5 oz + 1.7 lb & 32 oz + 1.7 lb	0 a	97 a	0 a	99 a	99 a	0 a	99 a	99 a	53 a
Pre & Post & Lpost										
Authority First & Liberty + AMS & Liberty + AMS	6.5 oz & 43 oz + 1.7 lb & 43 oz + 1.7 lb	0 a	95 b	0 a	99 a	99 a	0 a	99 a	99 a	55 a

RCB: 4 reps
Variety: LC 2250
Planting Date: 5/30/17
Pre: 5/31/17
Epost: 6/20/17 Soy cot-2 tri, 1-4 in; Cowh 1-4 in; Vele 2-3 in.
Post: 6/26/17 Soy uni-2 tri, 2-5 in; Cowh 1-6 in; Vele 2-4 in.
Lpost: 7/6/17 Soy 2-5 tri, 5-9 in; Cowh 1-4 in; Vele 1-3 in.

Precipitation: (inches)

Pre:	1st week 0.02	2nd week 0.00
Epost:	1st week 0.54	2nd week 0.89
Post:	1st week 0.87	2nd week 0.02
Lpost:	1st week 0.00	2nd week 0.01

Soil: Clay; 3.8% OM; 7.4 pH

P=0.05 (numbers in each column followed by the same letter are not significantly different)

Cowh=Common waterhemp
Vele=Velvetleaf
VCRR=Visual Crop Response Rating
(0=no inury; 100=complete kill)

Comments: Objective of the study was to evaluate increased rates of Liberty for weed control and crop response. Moderate velvetleaf and waterhemp weed pressure. All treatments provided excellent weed control and showed no crop response. There were no yield differences among herbicide treatments.

2017
ZIDUA PROGRAMS for WEED CONTROL in DICAMBA-TOLERANT SOYBEANS
Southeast Research Farm

Treatment	Rate/A	Cowh 6/26/17	Vele 7/11/17	Cowh 7/11/17	Vele 7/25/17	Cowh 7/25/17	Yield bu/A 10/18/17
Check	---	0 c	0 e	0 e	0 d	0 e	19 c
Pre-8003XR nozzles							
Zidua Pro	6 oz	73 a	41 c	40 bc	88 ab	69 b	19 c
Zidua Pro	4.5 oz	61 b	20 d	20 d	77 bc	56 d	23 bc
Pre-TTI 11003 nozzles							
Zidua Pro	6 oz	65 b	29 d	35 c	84 bc	62 bcd	23 bc
Zidua Pro	4.5 oz	59 b	25 d	25 d	71 c	64 bcd	25 bc
Zidua SC + Engenia	2.13 oz + 12.8 oz	69 a	57 b	49 b	72 c	66 bc	30 b
Zidua SC + Engenia + Pursuit	2.74 + 12.8 oz + 3 oz	62 b	61 b	44 bc	78 bc	68 b	29 b
Zidua SC + Engenia + Pursuit	3.3 oz + 12.8 oz + 4 oz	62 b	87 a	45 bc	80 bc	59 cd	30 b
Post-TTI 11003							
Zidua SC + Engenia + Pursuit + RU Powermax + Class Act Ridion	2.74 + 12.8 oz + 3 oz + 32 oz + 1%	--	99 a	98 a	99 a	95 a	63 a
Zidua SC + Engenia + Pursuit + RU Powermax + Class Act Ridion	3.3 oz + 12.8 oz + 4 oz + 32 oz + 1%	--	99 a	97 a	99 a	95 a	59 a
Pre & Post-TTI 11003							
Zidua SC + Engenia & Zidua SC + Engenia + RU Powermax + Class Act Ridion	2.13 oz + 12.8 oz & 2.13 oz + 12.8 oz + 32 oz + 1%	70 a	94 a	95 a	94 a	95 a	62 a
Zidua SC + Engenia + Pursuit & Zidua SC + Engenia + RU Powermax + Class Act Ridion	2.74 + 12.8 oz + 3 oz & 2.13 oz + 12.8 oz + 32 oz + 1%	70 a	99 a	98 a	99 a	97 a	62 a
Zidua Pro & Zidua SC + Engenia + RU Powermax + Class Act Ridion	4.5 oz & 2.13 oz + 12.8 oz + 32 oz + 1%	60 b	99 a	95 a	99 a	94 a	59 a

RCB: 4 reps
Variety: AG 20X7
Planting Date: 5/30/17
Pre: 5/31/17
Post: 6/26/17 Soy uni-2 tri; 2-5 in; Cowh 1-6 in; Vele 2-4 in.

Precipitation: (inches)
Pre: 1st week 0.02 2nd week 0.00
Post: 1st week 0.87 2nd week 0.02

Soil: Clay; 3.8% OM; 7.4 pH

Cowh=Common waterhemp
Vele=Velvetleaf

P=0.05 (numbers in each column followed by the same letter are not significantly different)

Comments: Objective of the study was to compare programs with Zidua. Moderate velvetleaf and waterhemp weed pressure. Treatments with a pre followed by a post or postemergence only treatments provided excellent season long weed control and had significantly better yield results.

2017
PANTHER PRO PREPLANT and PREEMERGENCE in NO-TILL SOYBEANS
Southeast Research Farm

Treatment	Rate/A	Cowh 6/26/17	Cowh 7/11/17	Cowh 7/25/17	Yield bu/A 10/17/17
Check	---	0 c	0 c	0 c	8 c
EPP & Epost					
Panther Pro + MSO & Xtendimax + Warrant	15 oz + 1% & 22 oz + 48 oz	71 b	80 b	68 b	32 b
Pre & Post					
Panther Pro + MSO & Xtendimax + Warrant	12 oz + 1% & 22 oz + 48 oz	84 a	91 a	88 a	49 a
Panther Pro + MSO & Xtendimax + Warrant	15 oz + 1% & 22 oz + 48 oz	81 a	95 a	95 a	53 a
Panther Pro + MSO & Xtendimax	15 oz + 1% & 22 oz	86 a	95 a	93 a	52 a

RCB: 3 reps
Variety: AG 20X7
Planting Date: 6/1/17
EPP: 5/12/17
Pre: 5/31/17 Cowh cot.
Epost: 6/20/17 Soy 2 tri, 3-4 in; Cowh 2-5 in.
Post: 6/26/17 Soy 2-3 tri, 5-7 in; Cowh 2-6 in.

Soil: Clay; 3.0% OM; 7.8 pH

Precipitation: (inches)

EPP:	1st week 2.11	2nd week 1.17
Pre:	1st week 0.02	2nd week 0.00
Epost:	1st week 0.54	2nd week 0.89
Post:	1st week 0.87	2nd week 0.02

Cowh=Common waterhemp

P=0.05 (numbers in each column followed by the same letter are not significantly different)

Comments: Objective of the study was to compare programs with Panther Pro. Heavy waterhemp weed pressure. To control existing weeds all treatments received an application of Roundup Powermax at 32 oz/A on 5/9/17 and an application of Spitfire (dicamba + 2,4-D) at 20 oz/A on 5/12/17. The early preplant followed by postemergence treatment showed significantly lower weed control and yield when compared to the preemergence followed by post treatments.

2017
FIERCE PLUS DICAMBA for BURNDOWN in DICAMBA-TOLERANT SOYBEANS
Southeast Research Farm

Treatment	Rate/A	Mata 6/26/17	Prle 6/26/17	Mata 7/5/17	Prle 7/5/17	Mata 7/25/17	Prle 7/25/17	Mata 8/14/17	Prle 8/14/17	Yield bu/A 10/17/17
Check	---	0 d	0 b	0 d	0 b	0 b	0 b	0 b	0 b	1 b
Pre*										
RU Powermax + Xtendimax + NIS	32 oz + 22 oz + 0.25%	60 c	88 a	99 a	99 a	99 a	99 a	99 a	99 a	49 a
RU Powermax + Xtendimax + Zidua Pro + NIS	32 oz + 22 oz + 6 oz + 0.25%	78 a	90 a	99 a	99 a	99 a	99 a	99 a	99 a	54 a
RU Powermax + Xtendimax + Valor EZ + NIS	32 oz + 22 oz + 2.5 oz + 0.25%	62 bc	90 a	98 ab	99 a	99 a	99 a	99 a	99 a	47 a
RU Powermax + Xtendimax + Fierce + NIS	32 oz + 22 oz + 3 oz + 0.25%	63 bc	88 a	98 ab	99 a	99 a	99 a	99 a	99 a	50 a
RU Powermax + Xtendimax + Fierce MTZ + NIS	32 oz + 22 oz + 1 pt + 0.25%	60 c	88 a	97 bc	99 a	99 a	99 a	99 a	99 a	52 a
RU Powermax + Xtendimax + Valor EZ + Dimetric	32 oz + 22 oz + 2.5 oz + 4 oz	66 bc	90 a	98 ab	99 a	99 a	99 a	99 a	99 a	51 a
RU Powermax + Xtendimax + Authority MTZ + NIS	32 oz + 22 oz + 11 oz + 0.25%	69 b	90 a	98 ab	99 a	99 a	99 a	99 a	99 a	52 a
RU Powermax + Xtendimax + Authority Elite + NIS	32 oz + 22 oz + 26 oz + 0.25%	64 bc	90 a	99 a	99 a	99 a	99 a	99 a	99 a	51 a
RU Powermax + Xtendimax + Valor EZ + NIS	32 oz + 22 oz + 2 oz + 0.25%	62 bc	90 a	96 c	99 a	99 a	99 a	99 a	99 a	48 a

* RU Powermax (32 oz) + Xtendimax (22 oz) + NIS (0.25%) applied Post to all treatments excluding the check.

RCB: 3 reps
Variety: AG 20X7
Planting Date: 6/1/17
Pre: 5/31/17 Mata 10-20 in; Prle 10-12 in.
Post: 6/26/17 Soy 2-3 tri, 5-7 in; Mata 3-5 in.

Soil: Clay; 3.0% OM; 7.8 pH

Precipitation: (inches)
Pre: 1st week 0.02 2nd week 0.00
Post: 1st week 0.87 2nd week 0.02

Mata=Marestail
Prle=Prickly lettuce

P=0.05 (numbers in each column followed by the same letter are not significantly different)

Comments: Objective of the study was to compare Roundup + Xtendimax burndown programs in soybeans. Heavy marestail and prickly lettuce weed pressure. Burndown control of marestail was marginal to poor. All treatments received the same postemergence treatment which provided excellent control. There were no yield differences among herbicide treatments.

SOUTHEAST RESEARCH FARM ANNUAL REPORT
South Dakota State University
2017 Progress Report
Agricultural Experiment Station
Plant Science Department
South Dakota State University, Brookings, SD 57007
Southeast Research Farm, Beresford SD 57004

Observations on Soil Temperature and Moisture in Relation to Tillage in 2017

Peter Sexton*, Duane Auch,
and Ruth Stevens

INTRODUCTION

Tillage influences residue levels and consequently also impacts soil temperature. This is particularly true for corn since its growing point is below ground up to the V6 growth stage (which generally occurs about 4 to 5 weeks after planting), so its rate of development early in the season is largely governed by soil temperature. With this in mind, soil temperature sensors were placed in different corn plots within a tillage trial to collect data on how tillage impacted soil temperature in the 2017 season at the Southeast Farm.

METHODS

Individual data loggers (Hobo Pendant Data Loggers, Onset Computer Corp., Bourne, MA) were placed at 2” depth in no-till and conventional-tilled plots within a field trial at the Southeast Farm. The plots that received data loggers were both corn and soybeans in a corn/soybean rotation, and corn grown in a corn/soybean/oat rotation under tilled and no-till management. Two plots of each treatment received a data logger placed 8” off the row on June 8, 2017. The corn had been planted on May 16, 2017 and the soybeans on May 30, 2017, both in 30” rows. The data loggers were retrieved in early November. The hourly soil temperatures for each plot were averaged for a given treatment. The difference in average temperature between treatments was then plotted over time so the reader can see how the tilled and no-till treatments compared over the course of the season.

In addition to the above, soil moisture sensors (model Em50 Data Logger with 5 TM Sensors, Decagon Devices, Pullman, WA) were placed at depths of 12” and 24” in three replicates comparing tilled versus no-tilled plots of corn in a corn/soybean rotation. These were installed several years ago with the support of the Sand County Foundation; however, some of the wiring was damaged by wildlife. Because of lingering problems from damage to wiring, the data is for the most part represented by two out of the three replications.

RESULTS AND OBSERVATIONS

Volumetric soil moisture for tilled and no-till corn at depths of 12”, and 24”, is shown in Fig. 1, and Fig. 2, respectively. At the 12” depth, soil moisture was similar at the beginning of the season for the two treatments. After a wet spring, the soil started to dry and on July 11 moisture in the tilled plots dropped below that observed in the no-till plots (Fig. 1). This difference continued to become greater until August 18th, at which point the tilled plots on a fraction basis (v/v) had 0.08 points less moisture

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than did the no-till plots (this would be about 1" less moisture per foot of soil in the tilled plot). At the 24" depth, the tilled plots showed lower moisture for practically the whole season, dropping to a value of about 0.27 on a v/v basis in early August (Fig. 2). These lower values of soil moisture suggest that the tilled plots were on the cusp of going into significant drought stress in early August; however, with rains that started on August 7th and continued through the month (totaling 7.97" for the whole month), the profile was effectively recharged and yields in the tilled plots were not lower than that observed in the no-till plots. If the dry weather had continued for another week or two, this data suggests that the tilled plots would have been significantly impacted by drought. As it was, August turned out to be cooler and wetter than average and severe drought was avoided.

Looking at soil temperatures, the tilled plots were initially warmer than the no-till plots and as the crop developed and shaded the ground the temperature difference lessened and during seed-filling the no-till plots actually showed slightly warmer soil temperature on average (perhaps due to greater soil respiration) (Fig. 3). Separating this out, and looking at temperatures on soybean stubble (Fig. 4) and oat stubble (Fig. 5), we see that initially the difference was greater on the oat stubble than on the corn stubble, and that later the soil temperature on soybean stubble was warmer in no-tilled than in tilled plots (negative values in August and early September in Fig. 4). The trend here is for the soil temperature to be cooler under oat stubble than under soybean stubble in the no-till plots. In the developing soybean stand we see a similar trend for warmer temperatures with tillage in the first part of the season, with differences lessening as the canopy develops. Warmer soil temperatures in the tilled plots are both a blessing and a curse – in the early part of the season the warmer soil temperatures mean faster development of the crop. This is particularly true for corn where its growing point is below ground for the first month or so after planting (until the V6 stage of growth). On the negative side, warmer soil temperatures are also associated with drought stress, particularly later in the season. The warmer temperatures observed in the tilled soybean plots in July were probably not beneficial. Table 1 shows the average difference in soil temperature on a monthly basis. In June the tilled plots were on average 3 to 4 degrees F warmer than in the no-till plots. In July this evened out in the corn plots, but not with soybeans (probably because the beans were late to close the canopy in these plots). In other years we have seen a temperature difference closer to 2 degrees F that evens out by early July. In the 2017 season this particular field was planted late due to initially wet conditions and also for tiling operations to be completed. This in turn resulted in the plots canopying and covering the row later. Taking the results from this year for 3.5 F cooler soil with no-till, and combining it with previous observations (1.8 F cooler temperature), gives a rough estimate of 2.7 F cooler soil temperature during stand establishment. If we assume this is the case for 30 days after planting – that would mean the no-till corn would have about 80 fewer growing degree days by the time the V6 stage came around – this is the equivalent of 3 days relative maturity for corn.

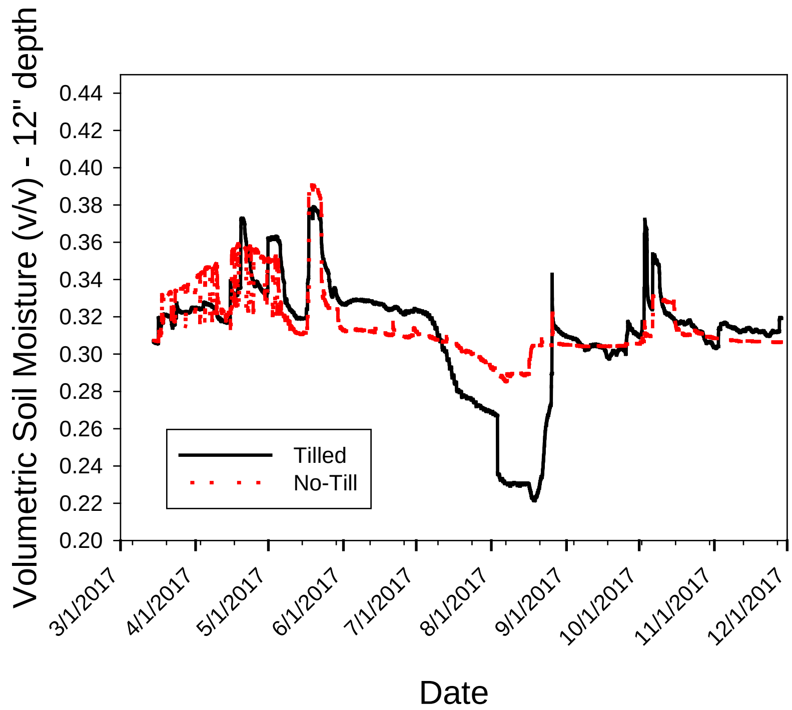

Fig 1. Volumetric soil moisture measured at a 12” depth for no-till and conventional tilled plots seeded to corn in a trial at the SDSU Southeast Research Farm in 2017. These plots are in a corn:soybean rotation. The data represent two replicates from the study.

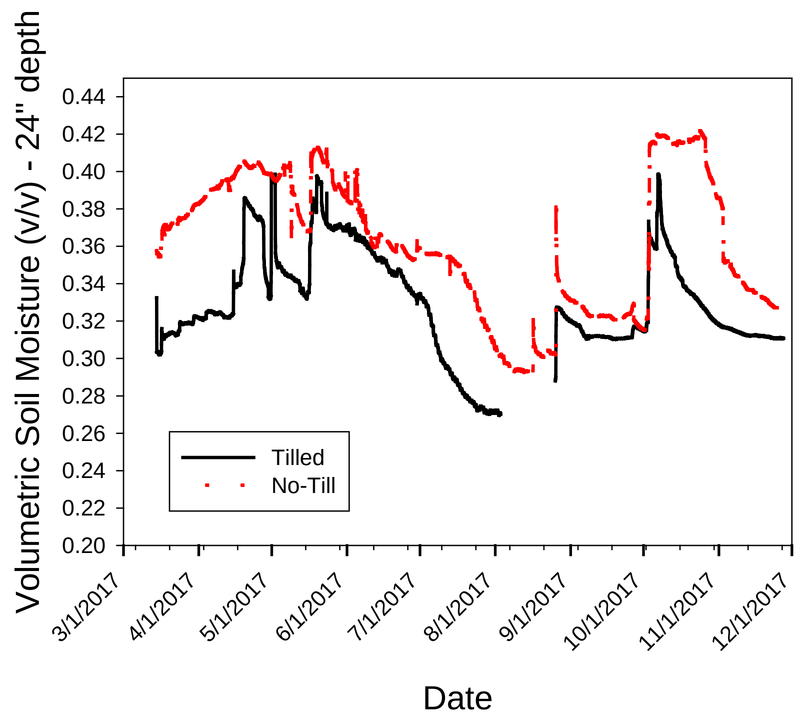

Fig. 2. Volumetric soil moisture measured at a 24” depth for no-till and conventional tilled plots seeded to corn in a trial at the SDSU Southeast Research Farm in 2017. These plots are in a corn:soybean rotation. The data represent two replicates from the study. There is a break in the data from Aug 4th through 25th for the tilled treatment due to missing data from one of the data loggers.

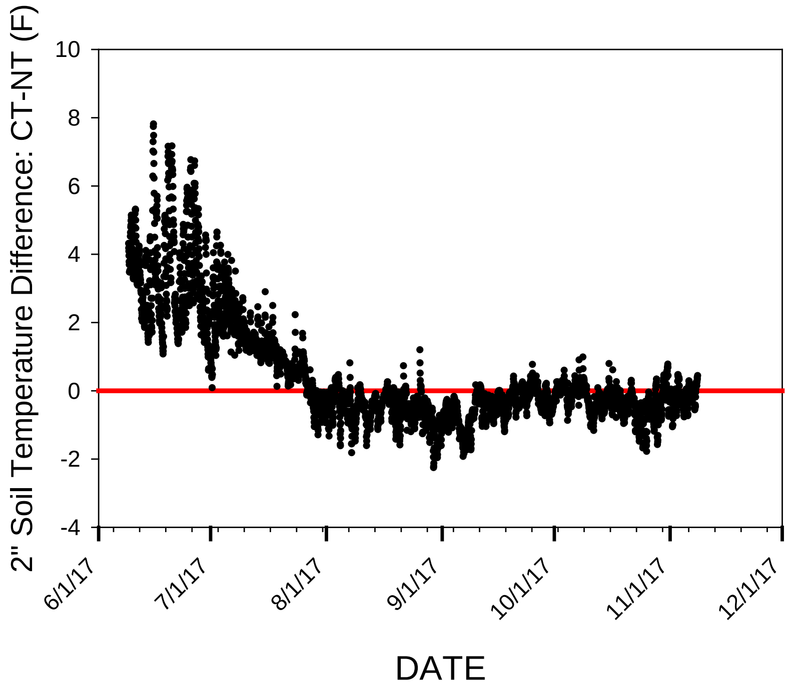

Fig 3. Differences in soil temperature (F) between tilled and no-till corn plots in a trial at the Southeast Research Farm in Beresford, South Dakota in 2017. Each point represents the difference in an hourly measurement of temperature at a 2" depth from four plots that were no-till and four plots that were tilled. For each set, two plots were on soybean stubble (corn:soybean rotation) and two plots were on oat stubble (corn:soybean:oat rotation).

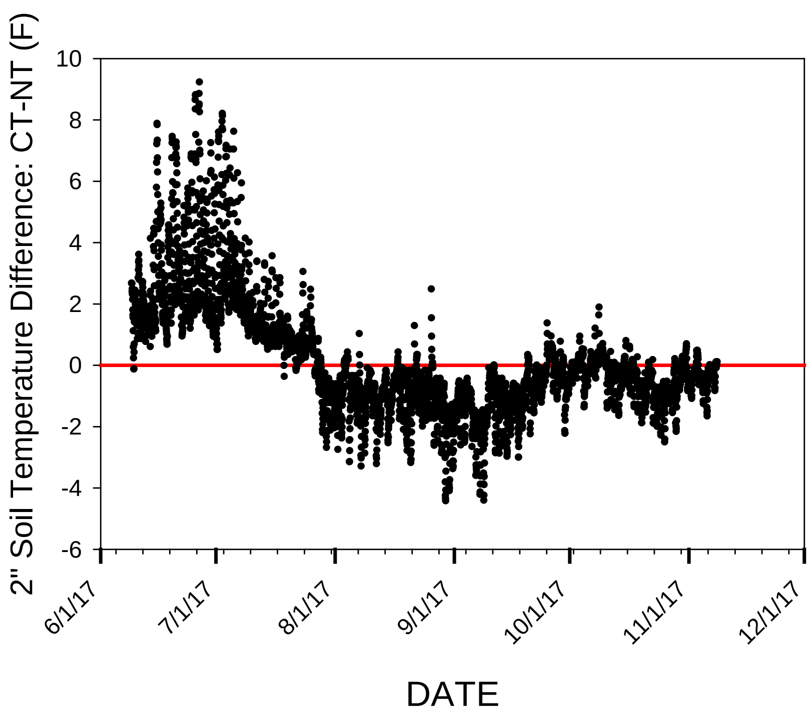

Fig. 4. Differences in soil temperature (F) between tilled and no-till corn plots in a trial at the Southeast Research Farm in Beresford, South Dakota in 2017. This data is a subset of the data shown in Figure 3 above. Each point represents the difference in an hourly measurement of temperature at a 2" depth from two plots that were no-till and two plots that were tilled for corn seeded into soybean stubble (corn:soybean rotation) .

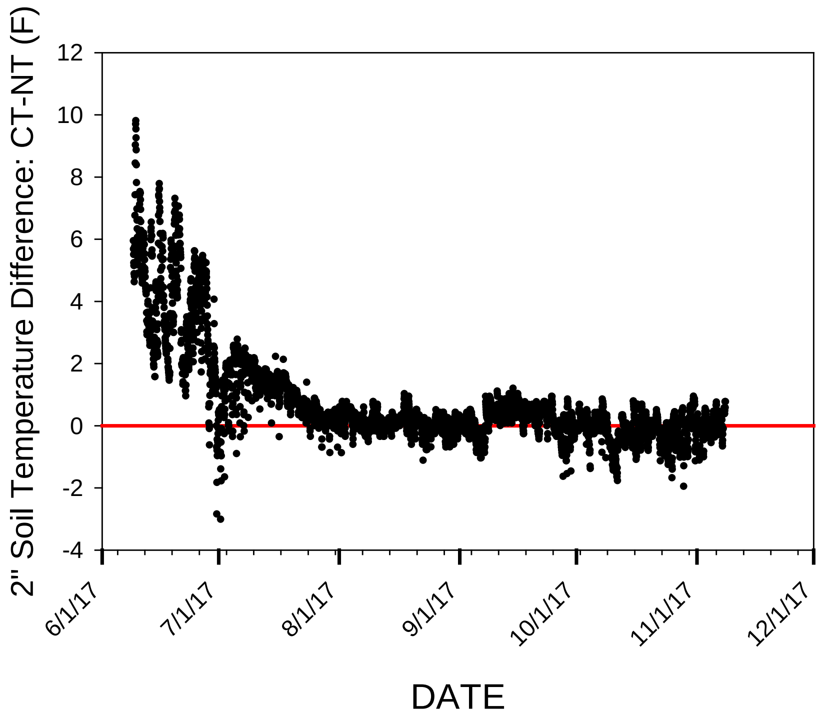

Fig. 5. Differences in soil temperature (F) between tilled and no-till corn plots in a trial at the Southeast Research Farm in Beresford, South Dakota in 2017. This data is a subset of the data shown in Figure 3 above. Each point represents the difference in an hourly measurement of temperature at a 2" depth from two plots that were no-till and two plots that were tilled for corn seeded into oat stubble (corn:soybean:oat rotation) .

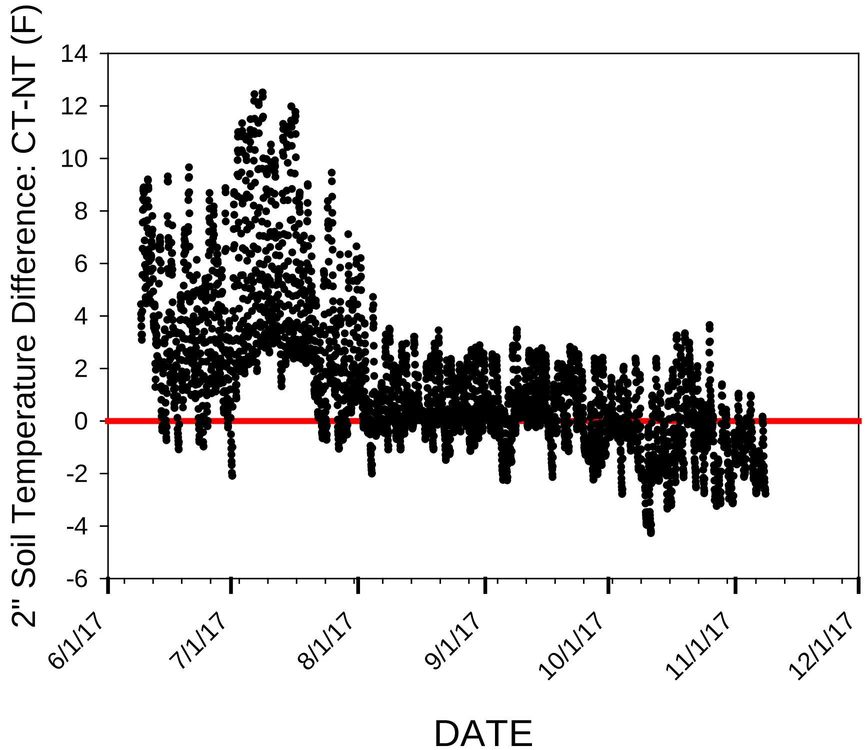

Fig. 6. Differences in soil temperature (F) between tilled and no-till soybean plots in a trial at the Southeast Research Farm in Beresford, South Dakota in 2017. Each point represents the difference in an hourly measurement of temperature at a 2" depth from two plots that were no-till and two plots that were tilled for soybeans seeded into corn stubble.

Table 1. Average difference in soil temperature at a 2" depth for corn and soybeans in a tillage trial conducted at the SDSU Southeast Research Farm in 2017. The crops were seeded in 30" rows and the sensors were placed 8" off the row. The corn average shown in the first column is the mean value across rotations; the "2 year" column refers to a two year rotation (corn: soybean – so corn is planted on soybean stubble); the "3 year" column refers to a three year rotation (corn:soybean:oat – so corn is planted on oat stubble). The abbreviations "CT" and "NT" refer to "conventional tillage" and "no-till" respectively.

Month	**Corn Average CT-NT**	**Corn 2-Year CT-NT**	**Corn 3-Year CT-NT**	**Soybean 2-Year CT-NT**
	(F)	(F)	(F)	(F)
June	3.5	3.1	3.9	3.6
July	1.2	1.4	1.0	4.4
August	-0.5	-1.1	0.1	0.7
Sept.	-0.4	-1.1	0.2	0.4

SOUTHEAST RESEARCH FARM ANNUAL REPORT
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2017 Progress Report
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Plant Science Department
South Dakota State University, Brookings, SD 57007
Southeast Research Farm, Beresford SD 57004

2017 Crop Performance Testing Results for SERF: Corn, Soybean, Winter Wheat, and Oats

Jonathan Kleinjan*, Kevin Kirby, and Shawn Hawks

INTRODUCTION

The results of the SDSU Crop Performance Testing (CPT) program are released each year due in part to sponsorship by the SDSU extension service and the South Dakota Agricultural Experiment Station. Corn, soybean, winter wheat, and oat variety trials are conducted annually at the Southeast Research Farm location near Beresford, SD. The winter wheat breeding project manages the winter wheat variety trial at this location and the oat breeding project manages the oat variety trial. CPT personnel manage the corn and soybean trials. For more information about the CPT program, please visit their Facebook page: https://www.facebook.com/SDSUExtCropTesting

METHODS

Corn and soybean trials were planted in 30-inch rows with a SRES precision four-row planter. Four-row plots were planted to a length of 20 ft and the center two rows were harvested for grain yield. Small grain variety trials were drilled using John Deere no-till openers set on 8-inch spacing. At harvest, plots were 5 ft wide and 13 ft in length. Additional information about trial management can be found with the trial results.

RESULTS AND DISCUSSION

Results for the corn and soybean trials are included in the following pages and can also be found, along with the small grains trial results, on the iGrow website: http://igrow.org/agronomy/profit-tips/variety-trial-results/

The five-year average corn yields for this location are 216 and 213 bu/acre, respectively for the early (≤107 day RM) and late (≥108 day RM) maturity tests. Yields in 2017 were below average with early and late test averages of 198 and 184 bu/acre, respectively. Soybeans also performed better than the five-year average of 73 bu/acre (Group II trial), with 2017 yields of 78 bu/acre.

Winter wheat yields were similar in 2017 (81 bu/acre) to the 3-year average of 78 bu/acre. Winter wheat varieties recommended for the 2017-18 season, based on 3-year averages, are: Antero, LCS Compass, Denali, Freeeman, WB Grainfield, LCS Mint, and SY Wolf. The average yield for the oat variety trial was 109 bu/acre, which was slightly below the 3-year average of 122 bu/acre. Recommended varieties of oats for 2017 include: Deon, Goliath, Hayden, Natty, and Sumo.

ACKNOWLEDGEMENTS

The efforts of the following SDSU personnel are greatly appreciated: Oat Breeding Project – M. Caffe-Treml, N. Hall; Winter Wheat Breeding Project – S. Sehgal, S. Kalsbeck, C. Hall.

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2017 South Dakota Oat Variety Trial Results

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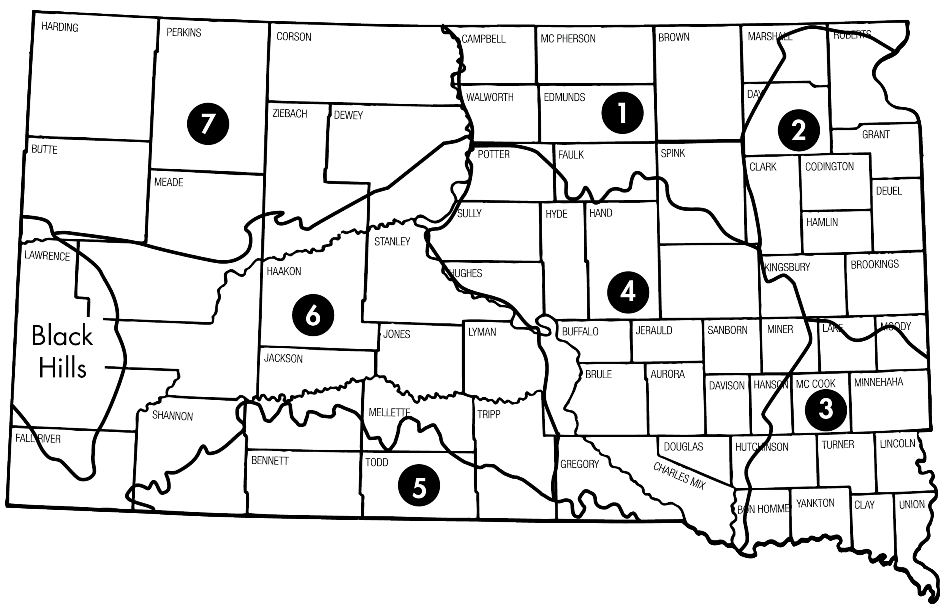
Crop Zones for Small Grains in South Dakota



Recommended Oat Varieties for Spring 2018 by Crop Zone†

Zone - 1	Zone - 2	Zone - 3	Zone - 4	Zone - 5	Zone - 6	Zone - 7
Deon	Deon	Deon	Deon		Deon	
Goliath	Goliath	Goliath	Hayden	Not	Hayden	Not
Hayden	Hayden	Hayden	Newburg	Evaluated‡	Horsepower	Evaluated‡
Newburg	Natty	Natty	Shelby427		Jury	
Souris	Sumo	Sumo	Souris		Natty	

† Crop Zones for small grains are base on soil & climate information. Recommended varieties are in the top 1/3 of the trial over 3 years for each zone.

‡ Varieties are not evaluated in this zone, however it is suggested to select a variety that appears frequently in the recommended list across all zones for the state or neighboring zones.

SDSU Extension

Table 1. List of 2017 oat testing locations and soil/cultural characteristics.					
Location	Testing location characteristics				
	Cooperator	GPS coordinates	Soil Type	Previous crop	Tillage system
East River Locations (6)					
Aberdeen	Locken Farms	45.475323° -98.542901°	Barnes-Cresbard-Tonka complex, 0 to 3 % slopes	soybeans	no-till
Beresford	SERF	43.044178° -96.900127°	Egan-Chancellor-Davison complex, 0 to 3 % slopes	soybeans	conv. till
Miller	Nathan Lichty	44.457747° -98.762627°	Davis silt loam, fans, nearly level	soybeans	no-till
Selby	Tom Fiedler	45.500531° -100.016584°	Highmore silt loam, cool, 0-2% slopes	soybeans	no-till
South Shore	NERF	45.105900° -97.097092°	Kranzburg-Brookings silty clay loams, 0-2% slopes	soybeans	conv. till
Volga	Volga Research Farm	44.302216° -96.922490°	Brandt silty clay loam, 0-2% slopes	soybeans	min-till
West River Locations (3)					
Draper	Paul Patterson	43.907778° -100.557500°	Kirley clay loam, 2-6% slopes	milo	no-till
Wall	Merritt Patterson & Sons	44.0813889° -102.308333°	Blackpipe silty clay loam, 0-2% slopes	safflower in 2015, then fallow	no-till
Winner	Jorgensen Land & Cattle	43.543707° -99.925344°	Milboro silty clay, 0-3% slopes	mile	no-till

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Table 2. Agronomic practices for 2017 oat trial locations.

Location	Agronomic practices					
	Planting date	Starter applied	Other Fertilizer applied	Herbicide applied	Fungicide applied	Harvest date
East River Locations (6)						
Aberdeen	04/11/17	90# 30-10-10	120-26-20-5S pp	1 pt Brox M Ultra	none	8/14/17
Beresford	04/11/17	65# 30-10-10	45# N as UAN	1 pt Bronate	none	8/11/17
Miller	04/04/17	90# 30-10-10	80-0-0-10S pp	1 pt Brox M Ultra	none	8/1/17
Selby	04/06/17	90# 30-10-10	---------location was hailed out on 6/20/17----------			
South Shore	04/17/17	90# 30-10-10	150-0-100 pp	Roundup Powermax (pre) 1 pt Bronate	none	8/8/17
Volga	04/13/17	90# 30-10-10	100-30-30 pp	1.7 pt Wolverine, 1 pt MCPA ester	7 oz Stratego	8/4/17
West River Locations (3)						
Draper	04/17/17	6 gal 10-25-0-5-.25	125# N as UAN mid-row banded	Roundup & Sharpen (pre) Widematch (post)	none	8/3/17
Wall	04/13/17	6 gal 10-25-0-5-.25	125# N as UAN mid-row banded	24 oz Roundup (pre)	none	7/19/17
Winner	4/11/17	90# 30-10-10	none	1 pt Bronate	none	7/28/17

2017 South Dakota Oat Variety Trial Results

Table 3a. East River Oat Performance - Average yield (14% moisture) and test weight, sorted by overall average yield.

Variety	Crop Zone - 1		Crop Zone - 2				Crop Zones 1 - 4		
	Aberdeen		South Shore		Volga		East River Average		
	Yield	Test Wt.	Yield	Test Wt.	Yield	Test Wt.	Top 1/3 %	Yield	Test Wt.
Hayden	77.0	30.5	162.1	34.1	159.5	36.0	80	117.5‡	32.7
Newburg	72.5	27.4	160.1	29.0	153.1	33.2	60	114.9	29.0
CS Camden	80.5	28.0	131.7	27.4	155.6	31.7	80	114.4	28.7
Deon	63.4	28.8	147.8	31.6	151.4	34.0	40	113.4	31.6
Goliath	70.2	31.8	153.5	33.0	158.4	35.0	40	113.1	32.9
Natty	73.8	30.4	152.0	33.3	149.2	34.8	40	111.4	33.0
Souris	77.1	29.2	144.0	30.9	155.3	33.7	60	110.8	30.7
Jury	79.5	29.4	142.9	32.0	157.7	33.8	40	110.1	31.1
Shelby427	78.9	31.7	140.5	34.0	143.0	35.9	40	108.7	33.6
Rockford	66.6	29.4	148.4	33.5	148.6	35.7	0	106.4	31.4
Horsepower	69.8	29.2	143.2	31.9	148.6	33.6	0	104.7	31.2
Jerry	57.2	28.7	143.3	33.1	128.8	34.5	0	99.4	32.1
Sumo	48.7	27.2	142.3	34.6	131.0	35.1	0	96.7	32.9
Antigo	59.2	30.0	117.2	35.7	131.1	36.7	0	96.1	33.8
Colt	46.8	27.8	132.2	35.8	123.6	35.8	0	93.8	32.8
*Streaker**	51.3	32.0	115.1	41.9	110.7	41.9	0	81.3	39.6
Trial Average	66.5	29.4	145.4	32.9	144.9	34.9	-	107.9	32.3
LSD(0.05)†	9.7	0.9	9.2	1.4	11.2	0.9	-	4.3	0.6
C.V.§	10.4	2.1	4.5	2.9	5.5	1.9	-	6.4	2.8

‡ Shading denotes varieties placing in the top 1/3 for yield at each location (Note: results for some experimental lines tested are not included in this publication).

† Yield or test weight value required to determine if varieties are significantly different from one another with 95% confidence.

§ C.V. (Coefficient of Variation) is a measure of variability or experimental error, >15% is acceptable.

* Hulless variety.

2017 South Dakota Oat Variety Trial Results

Table 3b. East River Oat Performance, continued - Average yield (14% moisture) and test weight, sorted by overall average yield.

Variety	Crop Zone - 3		Crop Zone - 4		Crop Zones 1 - 4		
	Beresford		Miller		East River Average		
	Yield	Test Wt.	Yield	Test Wt.	Top 1/3 %	Yield	Test Wt.
Hayden	104.3	30.9	84.5	32.0	80	117.5‡	32.7
Newburg	104.0	26.7	84.7	28.7	60	114.9	29.0
CS Camden	127.3	28.3	77.0	27.9	80	114.4	28.7
Deon	127.5	31.7	77.1	31.6	40	113.4	31.6
Goliath	109.0	32.9	74.5	31.7	40	113.1	32.9
Natty	113.8	34.9	68.2	31.6	40	111.4	33.0
Souris	93.1	28.9	84.4	30.8	60	110.8	30.7
Jury	94.5	28.7	75.9	31.3	40	110.1	31.1
Shelby427	99.1	33.5	82.3	32.7	40	108.7	33.6
Rockford	96.3	29.0	72.2	29.5	0	106.4	31.4
Horsepower	89.6	28.4	72.6	33.0	0	104.7	31.2
Jerry	97.9	31.8	69.8	32.3	0	99.4	32.1
Sumo	94.8	36.6	66.9	31.1	0	96.7	32.9
Antigo	108.5	35.3	64.7	31.4	0	96.1	33.8
Colt	94.7	32.6	71.8	31.8	0	93.8	32.8
*Streaker**	69.8	41.4	59.8	40.7	0	81.3	39.6
Trial Average	108.7	32.5	74.1	31.8	-	107.9	32.3
LSD(0.05)†	12.5	2.1	5.9	0.9	-	4.3	0.6
C.V.§	7.5	4.6	5.6	2.0	-	6.4	2.8

‡ Shading denotes varieties placing in the top 1/3 for yield at each location (Note: results for some experimental lines tested are not included in this publication).

† Yield or test weight value required to determine if varieties are significantly different from one another with 95% confidence.

§ C.V. (Coefficient of Variation) is a measure of variability or experimental error, >15% is acceptable.

* Hulless variety.

Table 4. West River Oat Performance - Average yield (14% moisture) and test weight, sorted by overall average yield.

Variety	Crop Zone - 6						Crop Zone - 6¶		
	Draper		Wall		Winner		West River Average		
	Yield	Test Wt	Yield	Test Wt	Yield	Test Wt	Top 1/3%	Yield	Test Wt
Hayden	120.8	33.0	71.3	37.0	41.5	35.8	100	77.8‡	35.2
Deon	115.7	31.0	70.7	35.6	40.8	36.6	67	75.7	34.4
Natty	112.1	34.1	76.1	38.1	31.3	37.0	67	73.2	36.4
Rockford	112.6	31.7	72.5	35.2	33.1	35.7	67	72.7	34.2
Souris	109.2	30.6	67.0	35.6	39.4	36.0	67	71.9	34.0
Jury	105.6	32.2	73.2	34.6	32.1	35.3	33	70.3	34.0
Horsepower	112.0	32.7	63.5	36.2	34.5	36.3	33	70.0	35.1
Jerry	111.3	33.2	68.1	37.0	27.9	36.3	33	69.1	35.5
Newburg	111.5	29.1	58.0	34.5	37.8	33.4	67	69.1	32.4
CS Camden	102.2	25.8	55.0	34.7	43.1	33.2	33	66.7	31.2
Shelby427	97.7	34.2	65.1	35.8	33.8	37.8	0	65.5	35.9
Antigo	90.1	34.3	70.8	38.8	33.7	38.5	0	64.9	37.2
Colt	87.8	34.1	64.4	39.1	30.8	37.7	0	61.0	37.0
Goliath	94.2	32.0	53.6	35.4	26.9	34.5	0	58.2	33.9
Sumo	81.9	35.2	53.6	37.2	30.8	37.1	0	55.4	36.5
*Streaker**	66.2	36.8	57.5	36.8	23.3	40.9	0	49.0	38.2
Trial Average	101.1	32.5	66.0	36.5	34.8	36.7	-	67.3	35.2
LSD(0.05)†	25.4	4.8	18.9	2.4	6.8	1.2	-	10.7	1.8
C.V.§	17.9	10.6	20.3	4.7	13.8	2.2	-	19.7	6.4

¶ There was no test in Crop Zone 5 or 7 in 2017.

‡ Shading denotes varieties placing in the top 1/3 for yield at each location (Note: results for some experimental lines tested are not included in this publication).

† Yield or test weight value required to determine if varieties are significantly different from one another with 95% confidence.

§ C.V. (Coefficient of Variation) is a measure of variability or experimental error, >15% is acceptable.

* Hulless variety

2017 South Dakota Oat Variety Trial Results

Table 5. 2015-2017 (3-Yr Average) East River Oat Variety Performance - sorted by overall yield (bu/ac @ 14% M).

Variety	East River (Crop Zones 1-4)						
	Crop Zone - 1		Crop Zone - 2		Crop Zone - 3	Crop Zone - 4	3-Yr East River Average
	Aberdeen	Selby§	South Shore	Volga	Beresford§	Miller§	
Deon	110.0	153.2	132.2	154.8	156.3	89.4	132.5‡
Hayden	116.7	161.3	130.4	142.1	137.6	102.3	131.5
Natty	105.7	145.0	127.9	146.2	140.9	84.0	125.0
Goliath	109.2	156.8	119.2	137.8	133.1	86.0	123.4
Newburg	112.6	154.7	119.3	126.5	127.6	93.1	122.0
Souris	111.4	162.7	104.6	121.0	101.8	96.0	115.8
Jury	110.1	144.0	111.5	123.9	119.7	86.1	115.8
Shelby427	102.7	115.9	120.1	125.8	124.8	89.0	113.3
Rockford	111.6	148.3	106.3	115.9	107.8	88.1	112.7
Sumo	82.3	125.6	121.1	141.3	130.9	72.8	112.5
Horsepower	112.4	143.1	110.6	121.2	98.6	84.6	111.9
Colt	87.5	151.1	111.8	114.3	118.4	77.3	109.6
Jerry	88.9	143.9	116.8	115.6	116.2	72.5	108.8
*Streaker**	81.8	97.4	85.8	92.3	80.1	64.0	83.6
Trial Average	100.2	143.1	115.5	127.0	121.8	84.6	115.4
LSD(0.05)†	12.3	8.0	5.4	6.1	12.5	4.7	15.7

§ Selby is a 2 year average from 2015 & 2016, Beresford is a 2 year average from 2015 & 2017, Miller data is a 2 year average from 2015 & 2017.

‡ Shading denotes varieties placing in the top 1/3 for yield at each location.

† Yield or test weight value required to determine if varieties are significantly different from one another with 95% confidence.

* Hulless variety.

Table 6. 2015-2017 (3-Yr Average) West River Oat Variety Performance - sorted by overall yield (bu/ac @ 14% M).			
Variety	West River (Crop Zone 6)		
	Crop Zone - 6		
	Draper§	Winner	3-Yr West River Average
Hayden	94.5	80.0	81.9‡
Deon	85.0	71.3	74.0
Jury	83.5	71.6	73.8
Horsepower	85.5	71.5	73.5
Natty	85.2	68.5	73.3
Rockford	83.4	70.5	73.3
Souris	80.8	71.8	72.5
Newburg	83.4	64.9	68.4
Shelby427	66.6	70.7	67.2
Jerry	75.5	62.7	65.8
Goliath	75.8	62.5	64.0
Colt	67.4	63.8	63.3
Sumo	70.4	60.6	61.2
*Streaker**	54.0	52.9	52.4
Trial Average	77.9	67.4	70.6
LSD(0.05)†	10.9	8.1	7.2

§Draper data is a 2 year average from 2016 & 2017.

‡ Shading denotes varieties placing in the top 1/3 for yield at each location.

† Yield or test weight value required to determine if varieties are significantly different from one another with 95% confidence.

* Hulless variety.

2017 South Dakota Oat Variety Trial Results

Table 7. Oat variety origin, characteristics, grain quality, and disease ratings.

	Testing and Origin		Agronomic Characteristics			Grain Quality¶			Disease Ratings#			
Variety	Years Tested in SD	Origin†-Year	Rel.‡ Hdg. *days*	Rel.‡ Height *inches*	2017 Ldg Score §	Grain Color	Test Wt.	2017 Protein	Smut	Stem Rust	Crown Rust	2017 BYDV Score
Antigo	new	WI-17	1	0	1.6	Yellow	Good	16.0	-	-	MR	5
Colt	5+	SD-05	0	0	1.9	White	Average	14.9	R	MS	S	7
CS Camden	2	MS-16	7	1	1.5	White	Low	14.1	-	*(S)**	MS	8
Deon	5+	MN-13	8	5	2.0	Yellow	Average	14.3	R	MR	R	4
Goliath	5+	SD-12	7	9	2.4	White	Average	14.6	R	R	S	2
Hayden	5+	SD-14	7	4	1.9	White	Average	14.1	R	MS	S	3
Horsepower	5+	SD-11	3	-2	2.0	White	Average	14.0	MR	R	S	6
Jerry	5+	ND-94	4	4	2.0	White	Average	14.4	MS	MS	S	6
Jury	5+	ND-12	6	7	2.5	White	Average	13.9	-	R	S	3
Natty	5+	SD-14	2	5	2.9	White	Average	14.9	R	MS	MS	5
Newburg	5+	ND-11	6	7	2.7	White	Low	13.6	S	R	S	4
Rockford	5+	ND-09	7	5	1.7	White	Average	14.5	MR-MS	S	S	4
Shelby427	5+	SD-09	2	4	1.8	White	Good	14.7	MR	MS	S	6
Souris	5+	ND-06	6	1	2.5	White	Low	13.9	MR	MS	S	6
Streaker††	5+	SD-09	3	5	2.1	Hulless	High	17.5	R	MR	MS	6
Sumo	3	ALS-16	0	2	1.7	White	Average	14.2	R	-	MR	6

† ALS - Albert Lea Seed, MN - Minnesota, MS - Meridian Seeds, ND - North Dakota, SD - South Dakota, WI - Wisconsin; - (Year of Release)

‡ Days to heading as compared to **Colt (162 days Julian)**. Height compared to **Colt (31 inches)** statewide.

§ Lodging score: Rating scale 1-5 (1=Standing perfectly to 5=Completely flat) based on 2016 East River locations.

¶ Based on 2017 East River test weight and protein.

Disease ratings: R - resistant, MR - moderately resistant, MS - moderately susceptible, S - susceptible, VS - very

* Ratings *(X)* based on information supplied by the entity submitting the variety.

†† Hulless variety.

2017 South Dakota Winter Wheat Variety Trial Results

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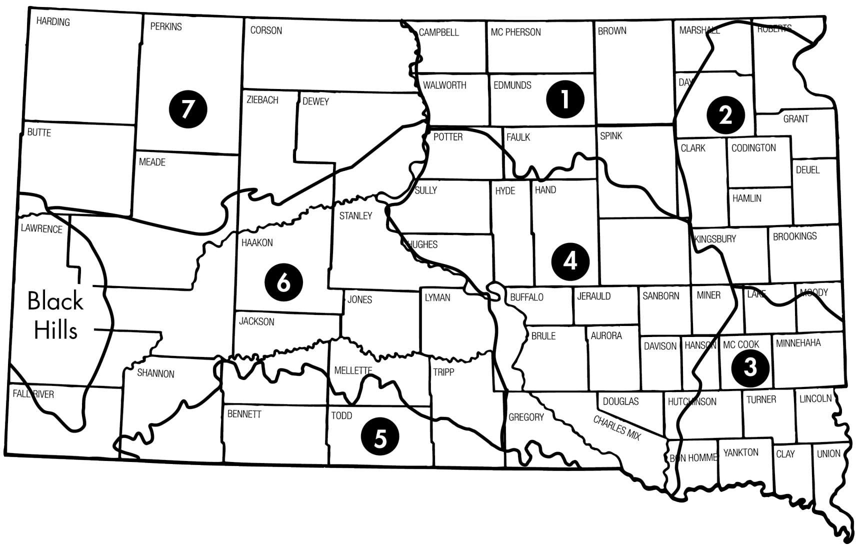

Recommended Winter Wheat Varieties for Fall 2017 by Crop Zone†

Zone - 1^{pc}	Zone - 2^{pc}	Zone - 3	Zone - 4^{pc}	Zone - 5	Zone - 6	Zone - 7^{pc}
Oahe	Oahe	Antero‡ (white)	Redfield	Oahe	Antero‡ (white)	Antero‡ (white)
Redfield	Antero‡ (white)	LCS Compass	Antero‡ (white)	Antero‡ (white)	Denali	WB Grainfield‡
Antero‡ (white)	Denali	Denali	Denali	Denali	WB Grainfield‡	LCS Mint‡
WB Grainfield‡	WB Grainfield‡	Freeman‡	SY Monument	Freeman‡	LCS Mint‡	SY Monument
Overland	LCS Mint‡	WB Grainfield‡	Ruth‡	SY Monument	SY Monument	Overland
SY Wolf‡	SY Monument	LCS Mint‡	SY Wolf‡	SY Wolf‡	Ruth‡	Wesley
	SY Wolf‡	SY Wolf‡			SY Wolf‡	SY Wolf‡

Promising

SY Sunrise	SY Sunrise	Avery‡	Avery‡	Avery‡	Avery‡	Ideal
	WB4614‡	Ruth	SY Sunrise	Cowboy‡	Cowboy‡	WB4614‡
		SY Sunrise		Ruth‡	Overland	
				Overland		

† Crop Zones for small grains are base on soil & climate information. Recommended varieties are in the top 1/3 of the trial over 3 years for each zone. Promising varieities are those in the top 1/3 of the trial over 2 years.

pc plant in protective cover to improve winter survival in Crop Zones 1, 2, 4, & 7 and in other zones when planting varieties with (Fair) or lower winterhardiness ratings

‡ Variety is susceptible or moderately susceptible to Fusarium Head Blight (Scab).

SDSU Extension

South Dakota State University, South Dakota counties, and USDA cooperating.
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2017 South Dakota Winter Wheat Variety Trial Results

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Table 1. List of 2017 winter wheat testing locations and soil/cultural characteristics.

Location	Testing location characteristics				
	Cooperator	GPS coordinates	Soil Type	Previous crop	Tillage system
East River Locations (8)					
Beresford	Southeast Research Farm	43.045210° -96.901664°	Egan-Clarno-Trent complex, 0-2 % slopes	Oats	No-till
Brookings	SDSU Foundation Seed	44.412416° -96.786848°	Kranzburg-Brookings silty clay loams, 0-2% slopes	Sp Wht	Min-till
Brookings - w/fungicide	SDSU Foundation Seed	44.412416° -96.786848°	Kranzburg-Brookings silty clay loams, 0-2% slopes	Sp Wht	Min-till
Onida	Tom Young	44.702751° -100.385525°	Agar silt loam, 0-2% slopes	Sp Wht	No-till
Pierre	Dakota Lakes	44.290081° -99.991518°	Dorna silt loam	Field peas	No-till
Platte (Geddes)	Curt Sybesma	43.361279° -98.705844	Highmore silt loam, 2-6% slopes	Soybeans	No-till
Selby	Mark Stiegelmeyer	45.440388° -100.080770°	Highmore silt loam, cool, 0-2% slopes	Lentils	No-till
South Shore	Northeast Research Farm	45.106144° -97.098665	Kranzburg-Brookings silty clay loams, 0-2% slopes	Oats	No-till
West River Locations (9)					
Bison	Brad Seidel	45.516389° -102.395000°	Morton loam, 2-6% slopes	Sp Wht	No-till
Faith (Dupree)	Bryant Schauer	44.970000° -101.905556	Rhoades-Daglum complex, 0-6% slopes	W Wht	No-till
Hayes	RDO	44.497778° -100.802222°	Opal-Chantier clays, 6-9% slopes	Sp Wht	No-till
Kennebec (Vivian)	Larson's c/o Logan Ruman	44.007500° -100.308056°	Promise Clay, 3-6% slopes	Millet	No-till
Martin	Mary Kay and Carl Novotny	43.214722° -101.601389	Redfield-Keith silt loams, 0-2% slopes	Fallow	No-till
Sturgis	Dave Wilson	44.503333° -103.481389°	Nunn Clay loams 0-2% slopes	W Wht	No-till
Wall	Dale Patterson	44.0813889° -102.308333°	Blackpipe silty clay loam, 0-2% slopes	Fallow	No-till
Winner	Jorgenson Land & Cattle	43.552242° -99.902533°	Millboro silty clay, 3-6% slopes	Oats	No-till
Winner - intensive	Jorgenson Land & Cattle	43.552242° -99.902533°	Millboro silty clay, 3-6% slopes	Oats	No-till

2017 South Dakota Winter Wheat Variety Trial Results

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Table 2. Agronomic practices for 2017 winter wheat trial locations.

Location	Agronomic practices					
	Planting date	Starter applied	Other Fertilizer applied	Herbicide applied	Fungicide applied	Harvest date
East River Locations (8)						
Beresford	09/21/16	90# 30-10-10	350# urea 60# AMS	1 pt Bronate, 4 oz Tilt	14 oz Caramba	7/19/17
Brookings	09/20/16	90# 30-10-10	160# urea	none	none	7/25/17
Brookings - w/fungicide	09/20/16	90# 30-10-10	160# urea	none	8 oz Prosaro (heading)	7/25/17
Onida	09/16/16	10 gpa 10-34-0	30 gpa 28-0-0	1 pt GoldSky	none	7/11/17
Pierre	09/15/16	10 gpa 10-34-0	20 gpa 24-0-0-8	0.9 pt Bronate	none	7/14/17
Platte (Geddes)	10/13/16	90# 30-10-10	270# urea 50# AMS	1 pt Widematch, 8 oz 2,4-D, 4 oz Tilt	4 oz Monsoon	7/18/17
Selby	09/18/16	10 gpa 10-34-0	250# urea/AMS	2 pt Hat Trick	none	7/26/17
South Shore	09/09/16	90# 30-10-10	300# urea 100# MAP	1 pt Bronate	none	7/24/17
West River Locations (9)						
Bison	9/29/16	6 gal 10-25-0-5.5Zn	35 gal 28-0-0 mid-row band	none	none	7/17/17
Faith (Dupree)	09/28/16	6 gal 10-25-0-5.5Zn	35 gal 28-0-0 mid-row band	1 pt GoldSky	10 oz Stratego	7/18/17
Hayes	09/19/16	6 gal 10-25-0-5.5Zn	35 gal 28-0-0 mid-row band	location was hailed out on 6/22/17		
Kennebec (Vivian)	09/20/16	6 gal 10-25-0-5.5Zn	35 gal 28-0-0 mid-row band	none	none	7/10/17
Martin	09/21/16	6 gal 10-25-0-5.5Zn	35 gal 28-0-0 mid-row band	1.3 pt Widematch, 4 oz 2,4-D	none	8/4/17
Sturgis	09/22/16	6 gal 10-25-0-5.5Zn	35 gal 28-0-0 mid-row band	none	none	7/11/17
Wall	09/27/16	6 gal 10-25-0-5.5Zn	35 gal 28-0-0 mid-row band	6 oz Barrage, 0.05 oz Ally	2 oz Tilt	7/13/17
Winner	09/14/16	10 gals 10-34-0	200# urea	2.2 pt Maestro Advanced	none	7/19/17
Winner - intensive	09/14/16	4 gals 7-25-5 + 0.5 gal inFuze	200# urea	2.2 pt Maestro Advanced	none	7/19/17

2017 South Dakota Winter Wheat Variety Trial Results

Table 3a. 2017 East River Winter Wheat Performance - Yield (13% moisture), Test Weight (harvest moisture), and Protein (13% moisture). Varieties yielding in the upper 1/3 of each trial location are denoted by gray shading.

Variety	Crop Zone - 1			Crop Zone - 2					
	Selby			Brookings			Brookings w/fung.#		
	Yield	Test Wt.	Protein	Yield	Test Wt.	Protein	Yield	Test Wt.	Protein
Alice (white)	45.7	60.1	14.7	82.2	58.9	13.6	77.5	59.2	13.0
Antero (white)	52.5	60.7	13.7	101.8	58.7	11.4	101.1	60.7	10.6
Avery	54.7	61.2	12.9	77.9	59.3	11.5	64.9	59.1	11.0
LCS Compass	43.3	60.6	15.4	58.4	58.1	13.0	58.8	59.3	12.5
Cowboy	49.4	59.6	13.9	75.8	59.3	11.4	76.1	59.5	10.5
Denali	50.6	61.1	13.7	82.3	58.7	11.3	81.5	60.0	10.6
Expedition	50.9	61.2	14.5	62.3	57.8	11.8	51.0	55.5	11.9
Freeman	43.8	59.6	13.6	81.1	56.6	12.2	89.6	59.3	11.2
WB-Grainfield	41.0	60.9	14.1	81.3	58.7	12.8	86.7	59.9	12.0
Ideal	53.3	60.0	14.3	63.9	57.9	11.6	61.3	58.3	11.3
Keldin†	47.3	59.9	14.5	88.7	59.0	12.1	95.4	60.5	11.5
Langin†	49.4	60.9	12.6	90.9	59.1	11.9	86.3	59.9	11.5
Long Branch†	49.4	60.8	13.0	98.1	58.0	11.9	97.2	59.6	12.0
Lyman	43.3	60.3	15.6	78.1	59.3	13.1	74.7	58.7	12.9
LCS Mint	45.0	61.4	14.2	83.4	58.6	12.1	79.1	60.1	11.7
SY Monument	46.8	59.8	13.6	88.8	57.7	11.8	81.1	59.4	12.2
Oahe	47.3	60.5	14.5	85.5	58.8	11.9	80.1	60.7	11.5
Overland	51.3	60.3	14.4	78.9	58.0	12.4	66.7	59.9	11.7
PSB13NEDH-7-140	41.4	60.0	16.1	80.8	59.0	13.0	89.3	60.6	11.6
PSB13NEDH-7-45†	47.5	60.8	14.2	77.2	59.3	12.4	83.3	61.1	11.0
Redfield	45.6	60.6	15.2	75.9	58.9	13.6	76.1	61.2	13.0
Ruth	46.8	60.3	14.4	82.0	58.0	12.7	74.3	58.8	12.3
SY Sunrise	53.9	61.1	13.7	78.0	57.0	13.1	80.0	60.1	12.2
Sunshine†	54.8	61.3	13.4	81.6	59.2	12.6	72.7	60.3	12.4
SY 517 CL2†	50.3	61.7	14.1	69.5	60.0	13.2	74.9	61.5	12.2
Thompson	50.5	59.7	14.4	71.4	58.7	12.5	75.9	59.0	12.1
WB4614	52.5	60.5	14.4	89.1	59.8	13.0	78.2	60.3	12.2
WB4721†	44.6	62.3	15.1	78.2	59.7	13.7	73.1	61.2	12.9
Wesley	44.4	59.6	14.9	78.0	57.9	13.5	67.4	58.3	11.9
SY Wolf	59.5	61.1	14.1	83.2	59.7	13.0	80.2	59.9	12.4
Trial Average	47.7	60.3	14.3	80.1	58.7	12.5	77.7	59.8	11.9
LSD(0.05)‡	10.6	0.8	0.9	6.5	1.3	0.4	7.3	1.6	0.8
CV(%)§	13.6	0.9	4.3	5.7	1.6	2.4	6.7	1.9	5.0

Foliar fungicide applied at flowering.

† New entry in 2017, not previously tested.

‡ Yield, test weight, or protein value required (≥LSD) to determine if varieties are statistically different than one another, § Coefficient of Variation (C.V.) is a measure of the variability of the experimental error, 15% or less is acceptable.

2017 South Dakota Winter Wheat Variety Trial Results

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Table 3b. 2017 East River Winter Wheat Performance, continued - Yield (13% moisture), Test Weight (harvest moisture), and Protein (13% moisture). Varieties yielding in the upper 1/3 of each trial location are denoted by gray shading.

Variety	Crop Zone - 2			Crop Zone - 3			Crop Zone - 4		
	South Shore			Beresford			Geddes		
	Yield	Test Wt.	Protein	Yield	Test Wt.	Protein	Yield	Test Wt.	Protein
Alice (white)	59.3	58.9	14.2	77.2	56.7	13.4	68.1	58.5	14.0
Antero (white)	77.3	59.8	12.7	84.3	58.1	11.6	83.8	60.6	11.4
Avery	49.3	57.6	12.5	87.4	58.7	11.1	84.2	59.9	12.0
LCS Compass	42.8	57.7	14.4	78.4	60.8	12.9	69.9	60.1	13.4
Cowboy	53.0	58.3	12.7	81.4	58.3	11.5	78.9	59.5	11.7
Denali	50.9	58.0	13.3	89.5	60.1	11.5	80.4	61.3	11.7
Expedition	32.2	57.5	14.0	79.7	56.9	12.6	72.6	60.7	13.3
Freeman	68.7	58.1	13.0	92.7	58.7	11.6	70.2	58.0	12.2
WB-Grainfield	74.4	59.7	14.2	91.7	59.9	12.0	74.9	60.0	12.5
Ideal	32.9	57.6	12.9	75.6	59.9	11.9	82.7	59.6	12.9
Keldin†	75.1	58.6	13.6	85.1	57.9	11.6	77.9	59.2	13.4
Langin†	73.1	57.7	13.1	89.1	57.3	11.7	72.4	58.2	12.0
Long Branch†	81.2	58.9	13.2	85.0	56.8	12.2	82.5	58.4	12.1
Lyman	47.1	57.0	15.6	57.7	57.7	13.6	69.1	58.5	14.0
LCS Mint	66.1	58.3	13.1	88.4	59.6	11.7	79.2	61.2	13.3
SY Monument	79.4	58.2	13.6	86.7	58.1	12.3	79.0	58.6	12.2
Oahe	68.0	59.8	15.1	76.3	60.9	12.2	76.1	61.0	12.7
Overland	56.0	58.7	14.1	73.2	59.0	12.3	82.1	59.1	12.5
PSB13NEDH-7-140	67.7	58.5	15.3	79.6	61.1	12.5	71.9	60.4	13.7
PSB13NEDH-7-45†	65.2	58.8	13.6	87.9	61.0	11.2	82.5	60.2	12.3
Redfield	62.9	57.9	13.8	81.5	59.3	12.5	79.4	59.5	13.7
Ruth	71.2	59.1	13.6	86.1	58.7	12.6	83.1	59.2	13.0
SY Sunrise	71.8	58.9	14.2	93.1	60.0	11.7	78.6	59.4	12.5
Sunshine†	55.1	57.2	13.4	81.9	56.5	11.9	79.6	59.6	12.5
SY 517 CL2†	59.5	59.3	13.6	84.9	59.9	11.6	76.5	60.6	13.4
Thompson	51.8	57.5	14.5	73.0	59.2	12.6	78.0	58.4	13.7
WB4614	62.0	57.2	14.1	77.4	57.9	12.4	81.1	57.7	13.8
WB4721†	69.4	60.0	15.3	86.3	60.3	12.5	81.3	61.2	13.7
Wesley	51.0	56.8	14.3	81.7	60.2	12.3	76.0	59.3	14.1
SY Wolf	78.5	59.4	14.6	84.6	58.1	13.2	81.8	59.8	13.5
Trial Average	62.1	58.3	13.9	80.8	58.9	12.2	76.7	59.3	12.9
LSD(0.05)‡	4.4	1.1	0.5	6.1	1.2	0.8	7.2	1.1	0.9
CV(%)§	5.2	1.4	2.4	5.4	1.5	4.3	6.7	1.3	5.0

† New entry in 2017, not previously tested.

‡ Yield, test weight, or protein value required (≥LSD) to determine if varieties are statistically different than one another, § Coefficient of Variation (C.V.) is a measure of the variability of the experimental error, 15% or less is acceptable.

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2017 South Dakota Winter Wheat Variety Trial Results

Table 3c. 2017 East River Winter Wheat Performance, continued - Yield (13% moisture), Test Weight (harvest moisture), and Protein (13% moisture). Varieties yielding in the upper 1/3 of each trial location are denoted by gray shading.

Variety	Crop Zone - 4						Crop Zones 1, 2, 3, & 4			
	Onida			Pierre			East River Average			
	Yield	Test Wt	Protein	Yield	Test Wt	Protein	Top 1/3%	Yield	Test Wt	Protein
Alice (white)	48.3	59.8	12.4	38.7	62.0	14.7	0	61.6	59.1	13.8
Antero (white)	65.1	61.2	12.1	44.2	63.9	12.7	75	75.2	60.3	12.1
Avery	60.2	61.5	11.1	60.7	63.5	12.2	63	66.6	59.9	11.8
LCS Compass	39.2	59.9	13.3	39.3	63.5	14.4	0	53.4	59.9	13.7
Cowboy	34.3	59.2	13.3	55.5	62.9	12.5	13	62.9	59.5	12.2
Denali	56.2	62.1	12.1	60.4	64.5	12.2	88	67.9	60.6	12.1
Expedition	49.5	60.5	12.4	54.5	63.3	14.5	25	55.6	59.0	13.2
Freeman	45.7	58.2	12.2	52.8	61.5	13.2	25	67.4	58.5	12.5
WB-Grainfield	55.3	59.1	12.4	42.2	62.7	13.1	50	67.5	60.0	12.9
Ideal	56.5	60.2	12.4	62.2	62.7	14.4	50	59.7	59.5	12.8
Keldin†	57.3	61.0	12.9	51.2	61.4	14.2	63	71.2	59.6	13.0
Langin†	68.0	60.7	10.7	60.1	63.6	12.5	75	72.3	59.6	12.1
Long Branch†	57.6	59.1	11.8	64.9	62.8	12.1	75	75.9	59.2	12.4
Lyman	48.0	60.3	13.0	48.4	62.7	14.8	0	57.5	59.2	14.1
LCS Mint	51.6	62.9	11.3	39.3	64.0	13.0	25	65.9	60.7	12.6
SY Monument	42.4	59.3	11.7	54.3	62.3	12.5	38	69.8	59.1	12.5
Oahe	49.2	61.5	12.0	53.8	63.1	12.9	13	66.6	60.7	12.9
Overland	49.3	60.9	13.6	52.3	62.3	13.9	25	63.3	59.7	13.2
PSB13NEDH-7-140	45.7	61.4	13.5	52.5	62.8	14.4	13	65.5	60.4	13.7
PSB13NEDH-7-45†	43.6	58.3	13.7	58.0	63.2	13.0	50	67.7	60.2	13.2
Redfield	46.9	60.3	13.7	55.5	62.4	14.1	13	65.1	60.0	13.0
Ruth	54.7	60.1	12.9	47.4	63.0	13.8	50	67.9	59.7	12.7
SY Sunrise	55.2	62.6	12.5	58.7	63.5	13.4	63	71.0	60.3	13.3
Sunshine†	58.1	59.7	12.4	42.3	62.8	13.0	25	65.4	59.5	13.8
SY 517 CL2†	42.1	59.2	13.3	35.2	63.2	14.3	13	61.2	60.6	13.7
Thompson	54.3	60.6	13.7	55.3	62.5	14.2	38	62.8	59.4	13.5
WB4614	47.4	60.2	12.9	35.7	62.3	13.8	25	65.0	59.5	13.1
WB4721†	45.0	61.2	13.1	51.7	64.5	14.4	38	65.7	61.2	13.7
Wesley	40.0	57.7	13.4	48.6	61.3	14.7	0	60.4	58.7	12.7
SY Wolf	47.3	61.0	13.6	44.8	63.7	13.5	50	69.5	60.3	13.5
Trial Average	49.5	60.2	12.7	50.4	62.8	13.6	-	65.3	59.7	13.0
LSD(0.05)‡	14.8	2.0	1.2	9.7	0.8	0.8	-	3.0	0.5	0.3
CV(%)§	18.4	2.0	5.7	13.9	0.9	3.9	-	9.0	1.5	4.5

† New entry in 2017, not previously tested.

‡ Yield, test weight, or protein value required (≥LSD) to determine if varieties are statistically different than one another, § Coefficient of Variation (C.V.) is a measure of the variability of the experimental error, 15% or less is acceptable.

2017 South Dakota Winter Wheat Variety Trial Results

Table 4a. 2017 West River Winter Wheat Performance - Yield (13% moisture), Test Weight (harvest moisture), and Protein (13% moisture). Varieties yielding in the upper 1/3 of each trial location are denoted by gray shading.

Variety	Crop Zone - 5			Crop Zone - 6					
	Martin			Sturgis			Vivian		
	Yield	Test Wt.	Protein	Yield	Test Wt.	Protein	Yield	Test Wt.	Protein
Alice (white)	36.2	56.7	14.9	32.3	60.9	14.5	63.6	61.3	14.7
Antero (white)	50.9	58.7	12.6	43.2	62.7	11.9	62.4	63.1	12.0
Avery	44.5	57.9	12.0	46.5	62.2	11.6	54.6	62.9	11.7
LCS Compass	37.1	57.5	13.9	31.5	61.6	14.1	48.0	62.2	14.1
Cowboy	46.6	56.5	12.5	39.9	61.6	11.8	60.7	62.3	12.2
Denali	49.0	59.2	12.2	44.2	61.9	12.1	73.2	63.4	12.1
Expedition	36.2	57.3	13.2	34.2	62.3	12.9	60.2	62.6	13.9
Freeman	41.7	57.2	12.8	37.2	60.7	13.0	63.5	61.5	13.2
WB-Grainfield	34.9	57.0	13.8	41.7	62.1	13.2	62.7	63.1	12.8
Ideal	37.0	56.9	12.9	40.2	61.3	13.2	55.9	62.9	12.8
Keldin†	43.5	55.7	13.7	30.0	60.4	14.2	76.1	62.5	13.2
Langin†	36.8	58.4	13.3	41.0	61.7	12.7	63.0	62.7	12.4
Long Branch†	39.7	56.3	13.6	37.2	60.6	13.4	61.2	62.4	12.2
Lyman	32.7	56.5	14.5	39.0	61.4	14.4	57.2	62.0	14.1
LCS Mint	38.8	57.3	12.9	31.1	62.1	13.2	50.8	64.3	12.6
SY Monument	48.6	58.1	13.0	36.4	60.7	12.4	65.5	62.2	12.7
Oahe	40.2	56.9	13.4	35.9	62.2	13.7	57.3	62.6	13.9
Overland	46.5	58.2	13.2	39.2	61.6	13.2	61.4	61.9	14.1
PSB13NEDH-7-140	43.0	57.9	14.3	42.2	61.2	13.9	57.8	61.8	14.7
PSB13NEDH-7-45†	42.9	58.0	13.4	40.0	62.2	13.1	51.3	62.8	13.3
Redfield	41.0	56.3	13.6	34.1	61.0	14.4	50.0	62.2	14.2
Ruth	48.0	58.2	13.2	38.4	62.0	13.5	59.3	62.8	13.5
SY Sunrise	30.4	57.9	14.2	35.0	62.2	14.2	61.4	63.3	13.7
Sunshine†	44.8	58.6	13.0	47.7	61.0	12.8	67.1	63.1	12.0
SY 517 CL2†	35.5	58.3	14.7	34.6	62.0	14.0	55.4	63.1	13.6
Thompson	41.2	59.0	13.3	33.9	61.3	13.9	55.7	62.1	13.0
WB4614	43.1	58.0	12.8	44.6	61.9	13.0	52.6	62.7	12.0
WB4721†	41.5	59.6	14.5	32.6	62.8	14.7	41.9	63.8	14.2
Wesley	48.6	56.1	13.9	33.3	60.1	14.5	58.9	61.3	13.9
SY Wolf	48.2	57.4	13.4	40.0	61.6	13.4	58.0	63.5	13.3
Trial Average	41.8	57.4	13.4	37.9	61.3	13.4	58.1	62.4	13.3
LSD(0.05)‡	9.6	2.2	0.8	8.2	1.2	1.0	18.8	0.5	0.8
CV(%)§	16.5	2.8	3.8	15.5	1.4	5.3	23.1	0.6	9.7

† New entry in 2017, not previously tested.

‡ Yield, test weight, or protein value required (≥LSD) to determine if varieties are statistically different than one another, § Coefficient of Variation (C.V.) is a measure of the variability of the experimental error, 15% or less is acceptable.

2017 South Dakota Winter Wheat Variety Trial Results

Table 4b. 2017 West River Winter Wheat Performance, continued - Yield (13% moisture), Test Weight (harvest moisture), and Protein (13% moisture). Varieties yielding in the upper 1/3 of each trial location are denoted by gray shading.

Variety	Crop Zone - 6								
	Wall			Winner			Winner intensive		
	Yield	Test Wt.	Protein	Yield	Test Wt.	Protein	Yield	Test Wt.	Protein
Alice (white)	41.2	62.0	13.9	39.2	59.5	14.2	42.9	57.7	15.3
Antero (white)	62.2	63.0	11.8	57.4	61.3	12.0	48.9	60.0	13.3
Avery	49.1	62.3	11.8	54.3	61.4	11.5	61.2	59.8	13.5
LCS Compass	42.9	62.4	14.1	39.9	61.1	14.0	39.4	59.1	15.1
Cowboy	51.0	61.3	12.1	45.6	58.9	11.8	46.1	57.3	13.8
Denali	52.4	62.7	11.7	48.3	59.6	12.6	52.9	58.5	13.4
Expedition	53.6	62.8	13.2	37.8	60.2	14.7	42.1	59.2	15.1
Freeman	54.8	60.6	12.6	44.8	58.8	13.2	42.6	57.0	14.3
WB-Grainfield	40.8	63.0	13.8	41.6	60.0	13.2	55.5	59.1	14.4
Ideal	65.2	62.2	12.7	41.3	59.3	14.2	45.0	58.8	14.7
Keldin†	57.2	61.5	12.5	49.2	60.8	12.1	45.5	59.1	14.0
Langin†	70.0	62.4	11.8	53.9	61.3	11.8	54.2	59.7	12.8
Long Branch†	54.1	62.3	11.8	50.3	60.3	12.2	53.7	58.6	13.6
Lyman	50.3	61.8	12.9	29.7	60.0	14.1	40.7	59.0	15.3
LCS Mint	52.5	64.0	12.4	49.6	62.9	12.1	55.4	61.3	13.7
SY Monument	52.4	61.9	11.8	51.2	58.1	13.0	51.9	56.8	14.2
Oahe	47.2	62.8	12.5	45.3	61.3	12.5	48.8	59.5	14.1
Overland	58.7	62.4	12.5	44.0	60.4	13.8	46.5	59.4	13.9
PSB13NEDH-7-140	54.2	62.3	13.2	42.6	59.9	14.4	51.4	59.8	14.9
PSB13NEDH-7-45†	55.1	61.7	12.9	48.6	60.4	13.0	46.2	58.8	14.6
Redfield	40.5	62.1	12.5	46.2	59.7	13.9	47.9	58.6	15.0
Ruth	59.7	62.6	12.6	40.8	60.2	13.8	45.8	59.8	13.8
SY Sunrise	44.9	63.2	13.8	48.0	61.2	13.8	44.5	59.9	15.2
Sunshine†	60.5	63.2	12.6	44.4	61.1	13.6	43.8	59.1	15.2
SY 517 CL2†	45.7	63.3	13.1	37.6	61.9	13.7	44.7	60.7	15.0
Thompson	58.3	61.7	12.3	46.0	60.3	12.8	44.5	58.5	14.5
WB4614	47.2	61.4	11.9	40.5	60.7	12.6	46.2	59.3	14.5
WB4721†	46.0	64.4	13.1	38.4	62.8	14.8	43.6	60.8	15.3
Wesley	53.3	62.0	13.0	34.2	58.2	14.6	37.0	57.6	15.6
SY Wolf	57.4	63.3	12.6	49.6	60.7	12.5	43.4	59.6	13.9
Trial Average	52.4	62.2	12.6	43.9	60.2	13.2	47.6	59.0	14.3
LSD(0.05)‡	14.3	0.6	0.8	10.5	1.0	1.2	8.7	1.4	1.1
CV(%)§	19.5	0.7	4.5	17.0	1.2	6.4	13.0	1.7	5.3

† New entry in 2017, not previously tested.

‡ Yield, test weight, or protein value required (≥LSD) to determine if varieties are statistically different than one another, § Coefficient of Variation (C.V.) is a measure of the variability of the experimental error, 15% or less is acceptable.

Table 4c. 2017 West River Winter Wheat Performance, continued - Yield (13% moisture), Test Weight (harvest moisture), and Protein (13% moisture). Varieties yielding in the upper 1/3 of each trial location are denoted by gray shading.

Variety	Crop Zone - 7						Crop Zones 5, 6, & 7			
	Bison			Faith			West River Average			
	Yield	Test Wt	Protein	Yield	Test Wt	Protein	Top 1/3%	Yield	Test Wt	Protein
Alice (white)	8.2	59.8	15.0	32.2	59.3	14.3	25	37.0	59.6	14.6
Antero (white)	10.2	60.4	14.2	31.6	60.7	15.2	75	45.8	61.2	12.9
Avery	13.8	60.0	13.8	29.8	60.0	15.5	50	44.2	60.8	12.7
LCS Compass	10.2	60.0	14.5	27.5	60.1	15.6	0	34.5	60.5	14.4
Cowboy	9.7	57.7	14.5	18.4	60.8	15.2	13	39.7	59.5	13.0
Denali	16.1	60.6	13.5	22.0	60.6	15.9	75	44.8	60.8	12.9
Expedition	14.4	61.1	13.9	26.3	60.5	15.8	13	38.1	60.7	14.1
Freeman	9.6	59.5	14.6	27.1	58.9	15.3	13	40.2	59.3	13.6
WB-Grainfield	14.8	60.4	13.8	36.7	59.1	15.5	63	41.1	60.5	13.8
Ideal	17.8	61.1	14.3	36.2	59.0	15.7	50	42.3	60.2	13.8
Keldin†	9.0	56.0	14.6	23.0	59.9	15.5	38	41.7	59.5	13.7
Langin†	11.0	59.3	14.0	28.3	60.2	14.4	63	44.8	60.7	12.9
Long Branch†	14.3	59.6	13.5	27.5	59.4	14.9	38	42.2	59.9	13.1
Lyman	9.9	60.7	15.4	29.0	59.6	16.1	0	36.1	60.1	14.6
LCS Mint	9.2	56.2	14.7	30.3	61.4	14.6	25	39.7	61.2	13.3
SY Monument	15.6	61.2	13.0	26.8	58.3	14.3	63	43.5	59.6	13.0
Oahe	10.7	61.9	14.3	27.9	60.8	14.3	0	39.1	61.0	13.6
Overland	14.6	62.0	14.6	33.9	60.5	14.0	57	43.1	60.8	13.7
PSB13NEDH-7-140	14.5	59.9	15.2	32.6	60.9	14.6	50	42.3	60.5	14.4
PSB13NEDH-7-45†	11.1	60.7	14.5	27.2	59.1	14.3	38	40.3	60.4	13.6
Redfield	11.1	61.0	14.9	25.9	59.3	15.4	13	37.1	60.0	14.2
Ruth	9.6	60.5	14.4	23.6	60.0	15.6	25	40.6	60.8	13.8
SY Sunrise	13.2	61.8	13.7	25.0	61.0	14.3	25	37.8	61.3	14.1
Sunshine†	12.5	60.7	13.7	31.5	60.2	14.7	50	44.0	60.9	13.4
SY 517 CL2†	17.9	62.0	14.5	32.5	61.6	14.9	25	38.0	61.6	14.2
Thompson	12.7	60.4	15.2	28.5	59.1	15.7	13	40.1	60.3	13.8
WB4614	14.4	60.8	14.5	27.3	60.1	14.7	25	39.5	60.6	13.2
WB4721†	7.3	62.5	15.1	27.9	61.4	15.1	0	34.9	62.2	14.6
Wesley	17.0	61.7	14.9	30.8	58.9	15.6	25	39.1	59.5	14.5
SY Wolf	13.3	61.7	13.8	32.2	61.1	14.6	63	42.7	61.1	13.4
Trial Average	12.4	60.2	14.4	28.9	59.7	15.1	-	40.3	60.3	13.7
LSD(0.05)‡	5.8	2.9	0.7	11.0	1.4	1.9	-	4.0	0.6	0.4
CV(%)§	33.7	3.4	3.5	27.4	1.7	9.1	-	20.3	1.9	5.7

† New entry in 2017, not previously tested.

‡ Yield, test weight, or protein value required (≥LSD) to determine if varieties are statistically different than one another, § Coefficient of Variation (C.V.) is a measure of the variability of the experimental error, 15% or less is acceptable.

2017 South Dakota Winter Wheat Variety Trial Results

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Table 5a. 2015-2017 (2 and 3-year averages) East River Yield (bu/ac @ 13% moisture) Performance - sorted by overall 3-year yield. Varieties yielding in the upper 1/3 for each trial location are denoted by gray shading.

Variety	Crop Zone - 1		Crop Zone - 2				
	Selby		Brookings		Brookings w/fung.		South Shore
	2 year	3 year	2 year	3 year	2 year	3 year	2 year
Antero	82.6	80.6	87.3	72.7	91.3	81.0	78.0
SY Wolf	85.2	83.6	81.3	69.8	79.7	70.7	73.5
SY Monument	79.7	78.7	79.8	66.0	83.7	75.0	78.0
Denali	73.6	72.8	78.5	66.1	81.2	73.8	63.0
WB-Grainfield	77.1	79.9	82.2	67.1	77.0	67.9	71.6
Freeman	75.5	79.2	81.2	69.9	73.9	65.2	66.8
Oahe	79.7	81.5	75.2	66.1	80.5	72.8	68.8
Ruth	81.7	79.5	72.1	60.9	76.8	68.4	68.9
LCS Mint	79.7	75.5	74.1	62.6	78.3	69.7	71.2
Redfield	78.6	81.4	72.3	61.5	73.4	68.0	64.5
Overland	80.2	83.0	64.6	58.2	73.3	67.3	64.3
Thompson	81.4	79.1	71.1	60.4	68.2	62.1	57.9
Alice	79.1	79.9	67.4	57.5	67.0	60.0	66.0
Lyman	68.2	75.1	72.6	64.0	71.5	65.2	58.1
Ideal	70.1	74.2	64.8	57.5	66.7	61.6	53.9
WB4614	70.8	66.8	75.9	59.9	84.5	74.8	63.1
Wesley	73.4	74.0	66.3	57.6	72.3	64.0	59.5
Expedition	65.0	70.5	56.5	49.6	61.5	54.9	49.6
LCS Compass	64.3	69.2	56.8	50.7	58.5	55.5	57.6
SY Sunrise	88.6	-	73.6	-	75.4	-	75.6
PSB13NEDH-7-140	80.6	-	79.5	-	72.2	-	70.1
Avery	74.3	-	66.7	-	74.8	-	63.2
Cowboy	74.1	-	72.0	-	73.5	-	61.7
Keldin†	-	-	-	-	-	-	-
Langin†	-	-	-	-	-	-	-
Long Branch†	-	-	-	-	-	-	-
PSB13NEDH-7-45†	-	-	-	-	-	-	-
Sunshine†	-	-	-	-	-	-	-
SY 517 CL2†	-	-	-	-	-	-	-
WB4721†	-	-	-	-	-	-	-
Trial Average	78.3	78.4	72.6	61.8	74.4	66.9	65.2
LSD(0.05)‡	7.4	5.9	5.2	4.1	4.2	3.8	3.9

† New entry in 2017, not previously tested.

‡ Yield value required (≥LSD) to determine if varieties are statistically different than one another.

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2017 South Dakota Winter Wheat Variety Trial Results

Table 5b. 2015-2017 (2 and 3-year averages) East River Yield (bu/ac @ 13% moisture) Performance, continued - sorted by overall 3-year yield. Varieties yielding in the upper 1/3 for each trial location are denoted by gray shading.

Variety	Crop Zone - 3		Crop Zone - 4				Crop Zones 1-4	
	Beresford		Geddes	Onida		Pierre	East River Ave.	
	2 year	3 year	2 year	2 year	3 year	2 year	2 year	3 year
Antero	79.3	81.8	91.3	60.5	63.6	55.2	78.2	75.5
SY Wolf	79.1	82.6	93.1	50.8	56.9	57.1	75.0	73.2
SY Monument	74.9	80.4	88.7	51.8	56.4	60.7	74.7	72.5
Denali	79.0	85.7	93.1	58.5	57.5	61.1	73.5	71.4
WB-Grainfield	84.3	84.8	88.5	53.1	57.1	50.7	73.0	71.0
Freeman	83.6	85.7	88.1	51.4	53.5	58.5	72.4	70.7
Oahe	68.6	74.3	86.1	48.5	56.6	58.9	70.8	70.5
Ruth	80.0	80.8	95.4	56.1	57.9	55.8	73.3	70.5
LCS Mint	79.9	82.3	89.1	58.1	58.7	53.4	73.0	70.1
Redfield	71.4	77.0	87.5	54.2	57.2	60.4	70.3	69.5
Overland	67.2	72.2	88.7	52.4	56.1	57.9	68.6	68.2
Thompson	66.3	76.4	85.5	55.6	58.9	59.3	68.2	67.4
Alice	71.3	74.6	83.9	53.3	54.6	51.2	67.4	65.8
Lyman	57.9	67.0	83.1	48.0	54.0	55.8	64.4	65.3
Ideal	68.0	75.4	90.4	48.1	50.4	59.3	65.2	65.0
WB4614	66.0	72.5	84.7	46.8	49.1	50.8	67.8	65.0
Wesley	76.0	79.5	85.8	46.0	46.3	53.8	66.6	64.8
Expedition	69.5	79.1	87.3	52.1	51.3	56.4	62.3	62.0
LCS Compass	73.3	82.9	84.4	47.4	48.4	48.6	61.4	62.0
SY Sunrise	82.6	-	93.6	61.2	-	64.7	76.9	-
PSB13NEDH-7-140	71.5	-	86.6	50.7	-	58.4	71.2	-
Avery	80.1	-	91.3	57.6	-	57.2	70.7	-
Cowboy	77.3	-	90.0	44.5	-	**57.7**	68.9	-
Keldin†	-	-	-	-	-	-	-	-
Langin†	-	-	-	-	-	-	-	-
Long Branch†	-	-	-	-	-	-	-	-
PSB13NEDH-7-45†	-	-	-	-	-	-	-	-
Sunshine†	-	-	-	-	-	-	-	-
SY 517 CL2†	-	-	-	-	-	-	-	-
WB4721†	-	-	-	-	-	-	-	-
Trial Average	74.2	77.7	88.0	52.6	55.2	56.5	70.2	68.3
LSD(0.05)‡	4.4	4.9	4.2	7.3	5.3	7.1	2	4.5

† New entry in 2017, not previously tested.

‡ Yield value required (≥LSD) to determine if varieties are statistically different than one another.

2017 South Dakota Winter Wheat Variety Trial Results

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Table 6a. 2015-2017 (2 and 3-year averages) West River Yield (bu/ac @ 13% moisture) Performance - sorted by overall 3-year yield. Varieties yielding in the upper 1/3 for each trial location are denoted by gray shading.

Variety	Crop Zone - 5		Crop Zone - 6						
	Martin		Hayes	Sturgis		Vivian		Wall	
	2 year	3 year	3 year*	2 year	3 year	2 year	3 year	2 year	3 year
Antero	72.8	64.6	57.2	58.0	67.1	62.4	55.1	63.9	69.5
SY Monument	70.4	62.0	64.0	48.8	59.9	63.6	61.8	62.3	70.4
SY Wolf	64.6	61.7	62.5	53.1	60.9	57.3	63.3	59.9	62.3
Denali	65.9	64.3	63.6	53.5	60.5	66.2	58.8	62.6	71.8
WB-Grainfield	65.0	59.4	62.6	55.0	63.8	61.6	62.2	49.7	58.0
LCS Mint	65.0	58.7	61.5	49.1	61.6	55.9	54.6	59.4	65.4
Overland	67.2	60.3	59.9	52.6	59.2	57.2	56.2	61.9	63.8
Ruth	65.9	60.6	70.2	51.2	58.4	57.1	58.9	60.2	61.1
Freeman	64.1	61.3	60.4	51.6	61.1	60.4	56.9	60.4	62.3
Oahe	63.4	61.2	58.0	52.3	60.0	54.2	57.9	55.5	61.9
Ideal	58.4	55.9	58.4	50.3	57.7	57.0	52.3	65.6	69.5
WB4614	64.7	57.4	55.8	56.9	66.9	54.9	53.0	60.1	67.2
Thompson	60.7	60.7	61.1	46.8	56.6	54.2	57.8	56.8	59.4
Redfield	63.0	57.0	62.6	48.4	56.8	51.2	53.5	51.8	62.3
Wesley	61.8	55.7	58.7	49.0	55.4	55.3	51.6	55.1	58.7
Lyman	55.0	51.6	58.3	50.2	54.6	54.1	54.5	55.3	58.1
Alice	56.7	52.3	67.4	46.4	53.9	58.7	56.7	48.5	52.8
Expedition	50.5	50.2	59.5	48.4	53.2	57.0	54.4	54.5	61.1
LCS Compass	56.1	54.5	56.3	44.2	49.6	48.0	45.1	48.3	53.0
Avery	65.7	-	-	59.0	-	59.5	-	59.1	-
PSB13NEDH-7-140	66.5	-	-	50.8	-	56.1	-	58.6	-
Cowboy	65.6	-	-	54.0	-	60.5	-	63.0	-
SY Sunrise	55.3	-	-	49.0	-	**57.2**	-	55.0	-
Keldin†	-	-	-	-	-	-	-	-	-
Langin†	-	-	-	-	-	-	-	-	-
Long Branch†	-	-	-	-	-	-	-	-	-
PSB13NEDH-7-45†	-	-	-	-	-	-	-	-	-
Sunshine†	-	-	-	-	-	-	-	-	-
SY 517 CL2†	-	-	-	-	-	-	-	-	-
WB4721†	-	-	-	-	-	-	-	-	-
Trial Average	62.2	58.1	60.3	51.2	58.9	57.5	56.1	57.4	62.3
LSD(0.05)‡	7.3	5.7	8.5	5.1	3.8	10.2	8.9	8.1	6.6

*Hayes 3 year average includes only two years from 2015-2016.

† New entry in 2017, not previously tested.

‡ Yield value required (≥LSD) to determine if varieties are statistically different than one another.

2017 South Dakota Winter Wheat Variety Trial Results

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Table 6b. 2015-2017 (2 and 3-year averages) West River Yield (bu/ac @ 13% moisture) Performance, continued - sorted by overall 3-year yield. Varieties yielding in the upper 1/3 for each trial location are denoted by gray shading.

Variety	Crop Zone - 6				Crop Zone - 7				Crop Zones 5-7	
	Winner		Winner intensive		Bison		Faith*		West River Ave.	
	2 year	3 year	2 year	3 year	2 year	3 year	2 year	3 year	2 year	3 year
Antero	69.8	72.8	65.4	71.1	29.5	36.8	69.8	60.0	59.5	61.2
SY Monument	67.0	66.7	65.7	64.7	27.6	36.3	60.5	56.8	56.3	59.5
SY Wolf	66.7	68.0	56.2	58.7	28.6	36.8	59.1	57.8	54.0	58.4
Denali	62.4	58.5	65.9	65.2	28.7	39.8	55.0	48.8	55.8	58.1
WB-Grainfield	61.7	57.1	65.9	67.3	28.0	37.8	64.4	58.3	54.7	57.8
LCS Mint	69.2	66.6	72.0	68.7	29.0	35.8	61.3	54.6	55.6	57.7
Overland	61.8	61.3	60.6	63.9	27.5	36.1	58.2	53.3	54.4	56.4
Ruth	60.3	61.4	61.9	65.0	22.5	30.5	49.4	46.6	52.3	55.8
Freeman	62.9	62.8	56.3	61.0	21.3	32.6	55.8	51.4	52.4	55.7
Oahe	57.6	59.8	60.2	63.3	27.8	38.2	46.7	47.1	50.5	55.5
Ideal	57.6	59.4	56.4	60.8	28.9	37.3	58.5	51.8	52.2	55.1
WB4614	52.3	51.4	58.6	61.0	29.5	34.9	60.1	50.1	52.7	54.5
Thompson	56.6	60.0	54.7	58.3	22.9	32.8	51.9	49.9	49.3	54.3
Redfield	58.7	58.3	58.5	61.0	24.7	33.2	51.6	47.0	49.6	53.7
Wesley	54.8	53.3	57.0	55.8	31.3	41.1	59.4	50.8	51.5	52.7
Lyman	52.9	56.4	59.5	62.6	23.7	32.2	54.0	51.9	49.5	52.6
Alice	57.7	57.0	61.4	59.2	21.2	28.8	58.7	51.4	50.5	52.3
Expedition	54.7	53.8	54.6	57.0	25.4	33.2	57.2	50.1	49.2	51.7
LCS Compass	56.2	55.1	54.2	55.8	23.3	29.2	55.0	50.3	46.9	49.1
Avery	64.7	-	65.3	-	27.2	-	56.1	-	55.4	-
PSB13NEDH-7-140	61.0	-	60.1	-	28.0	-	55.8	-	53.2	-
Cowboy	61.7	-	59.4	-	22.7	-	52.5	-	53.1	-
SY Sunrise	64.6	-	60.5	-	26.5	-	58.3	-	51.9	-
Keldin†	-	-	-	-	-	-	-	-	-	-
Langin†	-	-	-	-	-	-	-	-	-	-
Long Branch†	-	-	-	-	-	-	-	-	-	-
PSB13NEDH-7-45†	-	-	-	-	-	-	-	-	-	-
Sunshine†	-	-	-	-	-	-	-	-	-	-
SY 517 CL2†	-	-	-	-	-	-	-	-	-	-
WB4721†	-	-	-	-	-	-	-	-	-	-
Trial Average	60.4	60.1	60.2	61.6	25.8	33.8	56.9	52.1	53.3	55.8
LSD(0.05)‡	6.7	5.6	6.3	5.1	4.4	5.8	8.4	6.2	4.1	4.0

*Faith 3 year average includes data from McLaughlin in 2015.

† New entry in 2017, not previously tested.

‡ Yield value required (≥LSD) to determine if varieties are statistically different than one another.

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2017 South Dakota Winter Wheat Variety Trial Results

Table 7. List of winter wheat varieties tested in 2017 along with origin, agronomic, and grain quality characteristics.

Variety	Testing and Origin		Agronomic Characteristics				Grain Quality		
	Years tested in SD trials	Origin†-Year	Rel.‡ Hdg days	Rel.‡ Height inches	Lodging Score§	Winter Hardi-ness¶	2017 Test Wt.	2017 Protein %	Baking Quality#
Alice (white)	5+	SD-06	1	-2	2.1	G	Low	Good	E
Antero (white)	3	PG-12	1	0	2.6	G	Good	Low	*(G)*††
Avery	2	PG-15	1	0	3.4	-	Avg.	Low	*(G)*
LCS Compass	3	LCS-14	0	2	2.5	G	Avg.	Good	*(E)*
Cowboy	2	WY-12	4	0	3.5	*(G)*	Avg.	Low	*(A)*
Denali	4	PG-11	4	1	2.3	G	Good	Low	*(A)*
Expedition	5+	SD-02	**0**	**0**	2.4	G	Low	Avg.	G
Freeman	5+	NE-13	-1	-1	2.1	F	Low	Avg.	A-G
WB-Grainfield	5+	WB-12	-2	1	2.3	F	Avg.	Avg.	G
Ideal	5+	SD-11	5	-2	3.5	G-E	Avg.	Avg.	A
Keldin†	new	WB-13	5	-2	1.8	*(E)*	Avg.	Avg.	-
Langin†	new	PG-16	-1	-3	2.6	*(E)*	Avg.	Low	*(G)*
Long Branch†	new	DG-16	-1	1	2.9	*(E)*	Avg.	Low	-
Lyman	5+	SD-08	1	1	2.6	G-E	Avg.	Good	A
LCS Mint	5+	LCS-12	1	1	2.0	G	Good	Avg.	*(G)*
SY Monument	3	AP-15	3	-2	1.9	G-E	Low	Avg.	*(G)*
Oahe	5+	SD-16	2	4	2.0	G-E	Good	Avg.	A
Overland	5+	NE-07	2	2	1.9	G-E	Avg.	Avg.	*(A)*
PSB13NEDH-7-140	2	LCS-exp	3	2	1.3	*(G)*	Good	Good	*(A)*
PSB13NEDH-7-45†	new	LCS-exp	1	-1	1.6	*(G)*	Avg.	Avg.	*(A)*
Redfield	5+	SD-13	4	-1	1.9	G	Avg.	Good	G
Ruth	3	NE-15	1	1	1.8	G	Avg.	Avg.	*(G)*
SY Sunrise	2	AP-16	2	-3	2.0	*(E)*	Good	Avg.	*(G)*
Sunshine†	new	PG-14	-1	-3	2.0	-	Avg.	Avg.	*(G)*
SY 517 CL2†	new	AP-17	0	-3	2.0	*(G)*	Good	Avg.	*(A)*
Thompson	3	SD-17	3	2	2.0	G	Avg.	Avg.	A
WB4614	3	WB-14	5	-3	1.5	G	Avg.	Avg.	-
WB4721†	new	WB-15	-1	-2	1.8	*(G)*	Good	Good	-
Wesley	5+	NE-99	1	-2	2.6	G	Low	Good	G
SY Wolf	5+	AP-11	1	-3	1.1	G	Good	Avg.	A

† AP, AgriPro; DG, Dyna-Gro Seed; LCS, Limagrain Cereal Seeds; NE, Nebraska (Husker Brand Genetics); PG, PlainsGold; SD, South Dakota; WB, WestBred; WY, Wyoming; and – (Year of Release).

‡ Difference in days to heading compared to **Expedition** (2017 from Brookings - **Julian date 150**). Height compared to **Expedition** (2017 in Brookings and Beresford - **39 inches**).

§ Lodging score: 1, perfectly standing; to 5, completely flat; ¶ Winter hardiness: E, excellent; G, good; F, fair; P, poor.

Baking quality: E, excellent; G, good; A, acceptable; P, Poor. Note: SDSU does not typically do baking quality analysis.

†† Estimated ratings *(X)*, based on information provided by entity that submitted the variety.

2017 South Dakota
Winter Wheat Variety Trial Results

Table 8. Winter wheat variety disease ratings.

Variety	Disease Ratings‡						
	2016# Stripe Rust	Stem Rust	2017 Leaf Rust	2017 Tan Spot	2017 SNB*	WSMV	2016# FHB (Scab)
Alice (white)	MS-S	MR	MS	MS	R	MS	MS
Antero (white)	MR	*(MR)¶*	MR-R	MR	MR	*(MS)*	S
Avery	S	*(S)*	MR-R	MR	R	*(R)*	MS
LCS Compass	S	*(R)*	MR-R	MS	MR	*(S)*	MR
Cowboy	S	*(MR)*	MS	S	MR	*(S)*	S
Denali	S	*(MS)*	MR-R	MS	S	*(MS)*	MR
Expedition	S	R	MS	MS	S	S	MR
Freeman	S	MR	MS	MS	MR	S	MS
WB-Grainfield	MR-MS	MR	R	MR	MR	MR	S
Ideal	S	MR	MR-R	MS	MS	S	MS
Keldin†	*(MR)*	-	MR	MR	MR	-	*(MS)*
Langin†	*(MR)*	*(S)*	MR	MR	R	*(MS)*	-
Long Branch†	*(MR)*	*(MR)*	R	MS	R	-	*(S)*
Lyman	S	R	MR	MR	MR	S	MR
LCS Mint	MS-S	MS	MR	MR	R	MR	S
SY Monument	MR-R	*(R)*	R	MR	MR	*(MS)*	MR
Oahe	MR	MR-MS	MR	MS	MR	MR	MR
Overland	S	MR	MR	MS	MS	MS	MR
PSB13NEDH-7-140	MS-S	-	MR	MS	R	-	MR
PSB13NEDH-7-45†	*(MS)*	-	R	MR	MR	-	-
Redfield	MR-MS	MR	MS	MR	MR	S	MR
Ruth	MS-S	*(MR)*	MS	MS	R	*(S)*	MS
SY Sunrise	MR-R	*(R)*	R	MS	MR	*(MR-MS)*	MR
Sunshine†	*(MS)*	*(MR)*	MR	MR	MR	*(MS)*	*(S)*
SY 517 CL2†	*(MR-MS)*	*(R)*	R	R	MR	-	*(MR-MS)*
Thompson	MR-MS	MR-MS	R	S	N/A	MS	MR
WB4614	MS	-	R	MR	MR	*(S)*	S
WB4721†	*(MR)*	-	MR	MS	MS	*(MR)*	*(S)*
Wesley	S	R	MS	MR	MR	S	S
SY Wolf	S	MR	R	MR	MR	MR	S

‡ Disease ratings: R, resistant; MR, moderately resistant; MS, moderately susceptible; S, susceptible.

Conditions in the 2017 SDSU disease nursery were not favorable for pathogen development, thus 2016 results are reported.

*Septoria/Stagonospora nodorum blotch

¶ Estimated rankings based on information provided by the entity that submitted the variety.

† new entry in 2017

2017 South Dakota Corn Hybrid Trial Results - Beresford

Jonathan Kleinjan | SDSU Extension Crop Production Associate
Kevin Kirby | Agricultural Research Manager
Shawn Hawks | Agricultural Research Manager

Location:	6 miles west and 3 miles south of Beresford (57432) in Clay county, SD (GPS: 43.053103, -96.889990)
Cooperator:	SDSU Southeast Research Farm - Peter Sexton, manager
Soil Type:	Egan-Trent silty clay loams, 0-2% slope, non-irrigated
Fertilizer:	144-0-0-20S preplant; 30-10-10 starter
Yield Goal:	200 bu/acre
Previous crop:	Soybeans
Tillage:	No-till
Row spacing:	30 inches
Seeding Rate:	31,400/acre
Herbicide:	Pre: 32 oz Roundup (glyphosate) + 1.33 pt Dual (metolachlor) + 4 oz Sencor (metribuzin) + 4 gal UAN Post: 12 oz Atrazine + 3 oz Callisto (mesotrione) + 1% V/V + UAN 2.5% V/V
Date seeded:	5/16/2017
Date harvested:	11/3/2017

Soil conditions: This location was very wet during and shortly after planting. Please pay special attention to the harvest population when evaluating hybrid performance.

2017 South Dakota Corn Hybrid Trial Results - Beresford

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Table 1a. Glyphosate-resistant corn hybrid variety performance results (average of 4 replications) - **Early Season Trial (107 day maturity or less)** at Beresford, SD.

Variety Information			Agronomic Performance				
Brand	Hybrid	Maturity Rating	Yield Bu/A (15.5%)	Moisture %	Test Wt. (lbs/bu)	Lodging* %	Final Stand (plants/A)
Channel	207-27STXRIB	107	**226.2**	20.7	59.8	0.4	27600
Nutech/G2 Genetics	5F-504	104	**223.3**	18.3	60.1	10.1	28200
Heine Seeds	823VT2PRO	107	**216.9**	22.7	53.0	2.3	28200
Dyna-Gro	D39DC43	99	**215.0**	16.3	58.8	2.4	28000
Great Lakes Hybrids	5556VT2RIB	105	**212.2**	17.4	59.0	1.2	26900
Check	CHECK	97	**210.9**	16.2	59.9	3.5	28200
Great Lakes Hybrids	5470STXRIB	104	**209.3**	17.4	59.9	5.4	28200
Wensman	W81041VT2RIB	104	**209.3**	17.3	60.8	3.6	26800
Dyna-Gro	D44VC36VT2P	104	**208.6**	17.1	59.3	2.1	26600
Wensman	W81069VT2RIB	106	**206.5**	17.9	60.1	1.3	25900
Heine Seeds	754STXRIB	105	204.9	16.8	60.3	3.6	27100
Thunder Seed	4695 RR	95	204.7	14.9	59.7	6.0	27000
Nutech/G2 Genetics	5D-906	106	204.6	19.3	60.1	3.2	23800
Channel	203-01STXRIB	103	204.1	16.9	57.9	0.4	26700
Channel	204-74VT2PRIB	104	203.5	17.1	59.1	3.1	24600
Masters Choice	MCT5661	106	203.3	18.7	57.7	1.8	28600
Nutech/G2 Genetics	5VN-4707	107	203.1	17.8	57.9	0.4	26700
Thunder Seed	4600 RR	100	203.0	16.5	60.0	9.4	25000
Titan Pro	TP 77-06 SS	106	202.2	18.0	58.3	1.0	22500
Renk	RK717SSTX	105	202.0	16.7	61.0	0.4	26800
Great Lakes Hybrids	5283STXRIB	102	201.0	17.5	59.0	0.0	27000
Wensman	W81058VT2RIB	105	200.6	17.9	61.7	3.4	25200
Hoegemeyer	7557 AM	105	199.2	17.5	60.3	5.8	26400
Heine Seeds	790VT2PRORIB	107	199.2	18.1	59.4	0.8	28200
Channel	205-19STXRIB	105	196.7	17.4	58.4	0.4	24900
Great Lakes Hybrids	5755STXRIB	107	196.3	19.0	57.8	0.5	23600
Thunder Seed	6794 VT2P	94	195.6	14.6	58.7	6.8	26800
Hoegemeyer	7088 AM	100	194.9	17.0	59.9	3.4	25500
Thunder Seed	7396 VT2P	96	193.2	13.2	58.5	6.8	27300
Hoegemeyer	7224 AM	102	192.0	17.5	60.6	1.9	29000
		Trial Average	197.9	17.3	59.4	2.4	25700
		LSD (0.05)†	21.0	0.9	1.0	3.7	1600
		C.V.‡	7.6	3.5	1.2	-	4.4

* Lodging percentage - stalks broken below the ear as a percentage of the final stand.

† Value required (≥LSD) to determine if varieties are significantly different from one another.

‡ C.V. is a measure of variability or experimental error, 15% or less is acceptable.

2017 South Dakota
Corn Hybrid Trial Results - Beresford

Table 1b. Glyphosate-resistant corn hybrid variety performance results, continued (average of 4 replications) - **Early Season Trial (107 day maturity or less)** at Beresford, SD.

Variety Information			Agronomic Performance				
Brand	Hybrid	Maturity Rating	**Yield Bu/A (15.5%)**	Moisture %	Test Wt. (lbs/bu)	Lodging* %	Final Stand (plants/A)
Dairyland Seed	DS-6106	106	191.9	17.7	60.7	0.4	26500
Great Lakes Hybrids	5626VT2PRO	106	191.8	18.2	62.0	1.4	23100
Miller Hybrids	RX215VT2P	107	189.0	19.3	58.2	1.5	21700
Thunder Seed	6798 VT2P	98	186.8	15.0	59.9	0.7	28100
Thunder Seed	7993 VT2P	93	186.0	14.5	59.9	1.2	26500
Heine Seeds	821VT2PRORIB	107	185.6	20.5	58.4	3.5	22900
Wensman	W91025STXRIB	102	184.5	14.9	60.8	1.8	24500
Thunder Seed	7793 SS	93	183.8	15.0	59.6	0.4	24200
Renk	RK776SSTX	107	182.3	20.6	59.2	0.0	22100
Nutech/G2 Genetics	X5FN-0306	103	180.7	17.2	60.9	0.8	27600
Thunder Seed	7603 SS	103	180.4	16.3	60.0	0.8	25400
Nutech/G2 Genetics	X5FN-0308	103	177.8	17.3	60.7	1.0	22100
Hoegemeyer	7333 AMXT	103	176.7	16.9	59.0	0.0	20300
Masters Choice	MCT5371	103	175.6	16.9	60.4	0.5	18800
Dairyland Seed	DS-9804SSX	104	168.9	17.8	59.0	1.4	23200
		Trial Average	197.9	17.3	59.4	2.4	25700
		LSD (0.05)†	21.0	0.9	1.0	3.7	1600
		C.V.‡	7.6	3.5	1.2	-	4.4

* Lodging percentage - stalks broken below the ear as a percentage of the final stand.

† Value required (≥LSD) to determine if varieties are significantly different from one another.

‡ C.V. is a measure of variability or experimental error, 15% or less is acceptable.

2017 South Dakota Corn Hybrid Trial Results - Beresford

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Table 2. Glyphosate-resistant corn hybrid variety performance results (average of 4 replications) - Late **Season Trial (108 day maturity or more)** at Beresford, SD.

Variety Information			Agronomic Performance				
Brand	Hybrid	Maturity Rating	Yield Bu/A (15.5%)	Moisture %	Test Wt. (lbs/bu)	Lodging* %	Final Stand (plants/A)
Hoegemeyer	8066 AM	110	**211.3**	20.2	58.6	5.6	25500
Nutech/G2 Genetics	5F-510	110	**210.5**	20.0	61.2	0.9	24900
Renk	RK871VT2P	111	**208.0**	21.3	57.1	1.1	28400
Miller Hybrids	RX13-11VT2P	113	**200.2**	19.7	59.8	1.9	24100
Titan Pro	TP 71-12 SS	112	**200.2**	22.3	57.4	0.4	27400
Great Lakes Hybrids	5910VT2PRO	109	**199.4**	20.1	57.7	1.0	21500
Channel	208-23STXRIB	108	**199.4**	20.9	58.9	0.0	25200
Channel	210-26STXRIB	110	**197.6**	22.1	56.7	0.0	26400
Miller Hybrids	M66-23G	110	**197.3**	21.3	54.7	0.0	18300
Check	CHECK	97	**197.3**	16.6	60.0	1.3	25700
Great Lakes Hybrids	6224STX	112	**196.4**	22.6	57.0	1.8	24800
Hoegemeyer	7946 AM	109	**195.7**	19.5	59.1	1.8	23600
Heine	852VT2PRORIB	112	**192.2**	24.8	58.0	1.0	25700
Wensman	W91095STXRIB	109	**190.0**	19.6	59.9	1.1	19800
Channel	213-19STXRIB	113	**188.6**	21.5	59.8	0.0	26100
Nutech/G2 Genetics	5F-308	108	186.8	20.0	59.8	0.5	22300
Titan Pro	TP 66-10 SS	110	186.1	21.5	57.6	0.5	20700
Great Lakes Hybrids	6462STXRIB	114	184.0	24.1	57.5	0.0	23200
Dairyland Seed	DS-9508RA	108	183.1	20.2	54.4	0.4	27900
Channel	209-53STXRIB	109	182.4	21.2	56.7	0.0	27300
Heine	837DGVT2PRO	111	182.1	21.7	58.0	3.5	28400
Nutech/G2 Genetics	5F-709	109	181.3	21.0	58.1	3.0	20800
Great Lakes Hybrids	6401STXRIB	114	176.1	22.6	58.2	0.0	26100
Renk	RK810SSTX	110	174.5	22.8	56.1	0.4	24100
Heine	863STX	112	174.0	24.4	57.3	0.0	26500
Channel	209-15VT2P	109	173.4	20.0	57.5	0.0	19700
Heine	856STXRIB	112	172.9	22.2	59.2	2.0	26900
Great Lakes Hybrids	6369VT2RIB	113	172.0	22.4	57.3	1.4	24000
Miller Hybrids	RX436VT2P	110	164.9	22.7	56.3	1.1	18900
Great Lakes Hybrids	5935STX	109	164.3	21.0	57.6	2.6	20300
Dyna-Gro	D50VC30VT2P	110	160.8	19.2	58.1	0.8	26000
Titan Pro	TP 59-08 SS	108	152.1	19.5	59.4	0.0	23100
Renk	RK792SSTX	108	145.6	19.1	59.0	0.0	24300
Renk	RK815SSTX	111	139.8	21.4	56.6	1.4	24200
		Trial Average	183.8	21.0	58.0	1.1	24200
		LSD (0.05)†	24.2	1.0	1.1	2.5	1800
		C.V.‡	9.4	3.6	1.3	-	5.7

* Lodging percentage - stalks broken below the ear as a percentage of the final stand.

† Value required (≥LSD) to determine if varieties are significantly different from one another.

‡ C.V. is a measure of variability or experimental error, 15% or less is acceptable.

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2017 South Dakota Soybean Variety Trial Results - Beresford

Jonathan Kleinjan | SDSU Extension Crop Production Associate
Kevin Kirby | Agricultural Research Manager
Shawn Hawks | Agricultural Research Manager

Location:	6 miles west and 3 miles south of Beresford (57432) in Clay county, SD (GPS: 43.046221, -96.901055)
Cooperator:	SDSU Southeast Research Farm - Peter Sexton, manager
Soil Type:	Egan-Clarno-Trent complex, 1-6% slopes, non-irrigated
Fertilizer:	None
Previous crop:	Corn (cover crop: Rye)
Tillage:	No-till
Row spacing:	30 inches
Seeding Rate:	165,000/acre
Herbicide:	Pre: 32 oz Roundup Power Max (glyphosate) + 1.33 pt Dual (metolachlor) + 4 oz Sencor (metribuzin) + 1 oz Sharpen (saflufenacil) Post: 0.3 oz FirstRate (cloransulam) + 10 oz Flexstar (fomesafen) + 4 oz Latch (drift retardant) + 1% UAN + 1% COC
Insecticide:	None
Date seeded:	6/1/2017
Date harvested:	10/17/2017

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2017 South Dakota
Soybean Variety Trial Results - Beresford

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Table 1. Glyphosate-resistant soybean variety performance results (average of 4 replications) - Maturity Group 1 at Beresford, SD).

Variety Information			Agronomic Performance		
Brand	Variety	Maturity Rating	**Yield (bu/ac@13%)**	Moisture %	Lodging Score (1-5)*
Great Lakes Hybrids	1953NR2	1.9	**80.3**	10.9	1.0
Dairyland Seed	DSR-1950/R2Y	1.9	**79.5**	11.0	1.0
Check	CHECK	1.4	77.5	11.1	1.0
Thunder Seed	SB8811N	1.1	75.7	11.3	1.0
Thunder Seed	3614 R2YN	1.4	75.5	10.9	1.0
Peterson Farms Seed	18X16N	1.6	75.3	11.1	1.0
Peterson Farms Seed	17X18N	1.8	72.4	10.9	1.0
Thunder Seed	SB8710N	1.0	72.4	11.3	1.0
		Trial Average	76.4	11.1	1.0
		LSD (0.05)†	2.6	0.5	-
		C.V.‡	2.4	3.1	-

* Lodging Score (1 = no lodging to 5 = flat on the ground)

† Yield or moisture value required (≥LSD) to determine if varieties are significantly different from one another. Yield values statistically similar to the overall trial winner are shown in **boldface**.

‡ C.V. is a measure of variability or experimental error, 15% or less is acceptable.

2017 South Dakota
Soybean Variety Trial Results - Beresford

Table 2a. Glyphosate-resistant soybean variety performance results (average of 4 replications) - Maturity Group 2 at Beresford, SD).

Variety Information			Agronomic Performance		
Brand	Variety	Maturity Rating	**Yield (bu/ac@13%)**	Moisture %	Lodging Score (1-5)*
Dairyland Seed	DSR-2616/R2Y	2.6	**84.3**	10.9	1.0
Prairie Brand	PB-2600R2	2.6	**83.2**	11.4	1.0
Titan Pro	TP-24X87	2.4	**82.4**	11.1	1.0
Wensman	W1208NRX	2.0	**82.0**	10.3	1.0
Great Lakes Hybrids	2063NRX	2.0	**81.7**	10.3	1.0
Credenz	CZ 2188 EXP	2.1	**81.3**	10.4	1.0
Renk	RS248NX	2.4	81.2	10.9	1.0
Prairie Brand	PB-2228R2	2.2	81.1	10.1	1.0
Renk	RS265NR2	2.6	80.6	10.8	1.0
Prairie Brand	PB-2197R2	2.1	80.0	10.3	1.0
Great Lakes Hybrids	2469R2	2.4	79.8	10.3	1.0
Titan Pro	TP-24R26	2.4	79.8	10.5	1.0
Stine	28BA02	2.8	79.3	11.3	1.0
Great Lakes Hybrids	2269NR2	2.2	79.2	10.4	1.0
Dyna-Gro	S23RY85	2.3	78.8	10.3	1.0
Prairie Brand	PB-2876R2	2.8	78.8	11.2	1.0
Great Lakes Hybrids	2870NRX	2.8	78.1	10.7	1.0
Stine	26BA32	2.6	78.1	10.7	1.0
Dairyland Seed	DSR-2330/R2Y	2.3	78.1	10.5	1.0
Wensman	W3228NR2	2.3	78.0	10.4	1.0
Peterson Farms Seed	17X21N	2.1	78.0	10.2	1.0
Prairie Brand	PB-2419R2	2.4	77.9	10.1	1.0
Great Lakes Hybrids	2673NRX	2.6	77.8	10.5	1.0
Prairie Brand	PB-2486R2	2.4	77.8	10.6	1.0
Wensman	W1233RX	2.2	77.6	10.3	1.0
Titan Pro	TP-21X46	2.1	77.4	10.2	1.0
Credenz	CZ 2558 EXP	2.5	77.1	10.9	1.0
Dyna-Gro	S26RS75	2.6	76.9	10.7	1.0
Prairie Brand	PB-2296R2	2.2	76.7	10.4	1.0
Titan Pro	TP-28X47	2.8	76.6	10.8	1.0
		Trial Average	77.9	10.6	1.0
		LSD (0.05)†	3.1	0.4	-
		C.V.‡	2.8	2.6	-

* Lodging Score (1 = no lodging to 5 = flat on the ground)

† Yield or moisture value required (≥LSD) to determine if varieties are significantly different from one another. Yield values statistically similar to the overall trial winner are shown in **boldface**.

‡ C.V. is a measure of variability or experimental error, 15% or less is acceptable.

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Table 2b. Glyphosate-resistant soybean variety performance results, continued (average of 4 replications) - Maturity Group 2 at Beresford, SD).

Variety Information			Agronomic Performance		
Brand	Variety	Maturity Rating	**Yield (bu/ac@13%)**	Moisture %	Lodging Score (1-5)*
Dyna-Gro	S24RY87	2.4	76.4	10.5	1.0
Great Lakes Hybrids	2551NR2	2.5	75.9	10.4	1.0
Check	CHECK	1.4	75.7	10.5	1.0
Dairyland Seed	DSR-2110/R2Y	2.1	75.4	10.3	1.0
Wensman	W1218NRX	2.1	75.4	10.6	1.0
Titan Pro	TP-20X57	2.0	74.8	10.9	1.0
Wensman	W1220NRX	2.2	74.7	10.4	1.0
Titan Pro	TP-26X37	2.6	74.0	10.6	1.0
Great Lakes Hybrids	2372NRX	2.3	73.3	10.2	1.0
Peterson Farms Seed	18X23N	2.3	72.3	10.5	1.0
Renk	RS228NX	2.2	72.2	10.8	1.0
Stine	26XB32	2.6	70.6	10.5	1.0
		Trial Average	77.9	10.6	1.0
		LSD (0.05)†	3.1	0.4	-
		C.V.‡	2.8	2.6	-

* Lodging Score (1 = no lodging to 5 = flat on the ground)

† Yield or moisture value required (≥LSD) to determine if varieties are significantly different from one another. Yield values statistically similar to the overall trial winner are shown in **boldface**.

‡ C.V. is a measure of variability or experimental error, 15% or less is acceptable.